An Analysis of Water Conservation Education Methods and Practices and their Effect on Water Usage in the Case of Durban's eThekwini Municipality

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As the candidate's supervisor I have/have not approved this thesis/dissertation for submission.

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Abstract

This study focuses on water conservation and awareness, through the use of water education. The eThekwini Municipality of Durban, in KwaZulu-Natal, South Africa, is the location chosen for observation, due to the long history of the Municipality's Department of Water and Sanitation involvement in South Africa's water policies.

The study of water education is examined under the conceptual framework of Sustainable Development, which is then further supported by the Education for Sustainable Development framework. Water education is understood as: 1) the water cycle, 2) sources of water, 3) human consumption and different users of water, 4) domestic uses of water and, 5) water used on a large scale (Middlestadt *et al.*, 2001). By understanding these key concepts, the cognitive, asset-based, and participatory development approaches are assessed to determine if they are being implemented to teach water education within eThekwini, and if they can be further applied to enhance current water education practices.

Data was collected as part of a qualitative study method, through literature review and one-on-one semi-structured interviews. Interviewees address how education plays a role in environmental outreach projects, how the three development approaches are being used, and how water education can be enhanced. Through content analysis, factors such as class, wealth, and accessibility were discovered to impose on many residents' ability to engage in water conservation efforts.

Within the formal education system, water education seems to be more prominent throughout primary education, with more inclusive and engaging approaches. Little water education seems to be provided in secondary education, and if done the approaches used are more outcome-based rather than inclusive or interactive approaches. Interviewees found more inclusive, engaging, and active methods to be most successful when implementing water education.

Water education can be enhanced through the use of the cognitive and participatory approaches; through formal education students are not encouraged to engage or participate and are therefore not strongly connected to the subject matter. As a result, students are not internalizing the information. The asset-based approach includes open discussions and an understanding of the local assets that are being impacted; this approach is therefore also recommended for further use.

COLLEGE OF HUMANITIES

DECLARATION - PLAGIARISM

I, ……., declare that

1. The research reported in this thesis, except where otherwise indicated, is my original research.

2. This thesis has not been submitted for any degree or examination at any other university.

3. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.

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List of Acronyms

ANC	African National Congress
CAPS	Curriculum Assessment Policy Statements
DBE	Department of Basic Education
EEASA	Education and Environment Program, the Environmental Education Association of Southern Africa
ESD	Education for Sustainable Development
FET	Further Education and Training
KZN	KwaZulu-Natal
NDP	National Development Plan
NWA	National Water Act
PAR	Participatory Action Research
RDP	Reconstruction and Development Programme
SA	South Africa
SD	Sustainable Development
SDGs	Sustainable Development Goals
UKZN	University of KwaZulu-Natal
WESSA	Wildlife and Environment Society of South Africa
WSA	Water Services Act

Acknowledgements

Dear Reader,

My name is Eliza and I have many people to thank for the support, strength, and continued encouragement that has been given to me which helped me to finish this dissertation. To begin with, I would like to give a special thanks to my past lecturers and professors that encouraged me to continue with my education and have assisted me in the process. The roles you have play in my life will not be forgotten. To the hardworking and approachable lecturers at UKZN, I greatly appreciate your patience through my constant questions and countless consultations; I also half apologize for my persistence!

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And to Elliot, the one who sees the true sleepless, stressed, and crazy academic that wrote this dissertation, thank you for bringing me some calm and sanity when I definitely did not have it.

"Increased amounts of *untreated sewage*, combined with *agricultural runoff* and *industrial discharge*, have degraded water quality and contaminated water resources around the world. Globally, *80% of wastewater flows back into the ecosystem without being treated or reused*, contributing to a situation where around 1.8 billion people use a source of drinking water contaminated with faeces, putting them at risk of contracting cholera, dysentery, typhoid and polio." (UN-Water, 2017b).

"When waters run dry, people can't get enough to drink, wash, or feed crops, and economic decline may occur. In addition, *inadequate sanitation*—a problem for 2.4 billion people—can lead to *deadly diarrheal diseases*, including cholera and typhoid fever, and other water-borne illnesses." (WWF, 2017)

"Local and national economies are more robust, as the risks and uncertainties related to the *availability of water* resources have been taken into account in the long-term *planning for poverty reduction and economic development*. Norms and attitudes have changed as a result of *educational interventions*, institutional changes, improved scientific and technical knowledge, *sharing of lessons learned and best practices*, and proactive policy and legislative developments." (UNESCO, 2015:8)

Chapter One: Introduction

1.0 Why Water?

The topics and questions discussed in this study emerged as a consequence of my early experiences during my many trips to Durban. The study of water is complex; certainly within the larger context of South Africa. The one aspect that I have continued to come across is the concept of saving water and water scarcity, seemingly caused by temperamental weather patterns. Residents throughout Durban, and other regions of South Africa, have been consistently instructed to conserve between 10-15% of water, but when engaging with residents about how this is meant to be done, few seem to know how. These interactions resulted in me questioning my own level of water education and whether it is a consequence of my own active participation within the environmental sector, or if the education that I have received throughout primary and secondary school is the source of my knowledge. This study therefore focuses on water conservation, local education, and awareness raising. The strategies, methods, and practices that are used to implement the aforementioned water themes, and the research conducted to enhance these, are analyzed. The questions then remain: why is water important, how are people educated about water in eThekwini, and why should anyone be concerned with the conservation and preservation of water?

1.1 The Importance of Water and Why We Should Care

Water is a finite resource that is quickly depleting, creating limited access for day-to-day use globally (UN-WATER, 2017a). It is one of the most essential and fundamental resources for the well-being of the human population and the natural ecological environment that surrounds us and we so heavily rely on (Liu *et al.*, 2016). Currently, communities around the world are experiencing increased demands for water, food, and energy, due to "rising global population, rapid urbanization, changing diets, and economic growth" (UN-WATER, 2017a). The agricultural sector is the largest consumer of freshwater, using 70% of freshwater reserves (UN-WATER, 2017a). Within the agricultural sector,

research has found that 70% of the consumed freshwater, nearly 60% is wasted due to leakages, mismanagement, and/or inefficient practices (WWF, 2017). Increasing water demand stems from the over-consumption and mismanagement of water as a resource and the scarcity of water in arid regions.

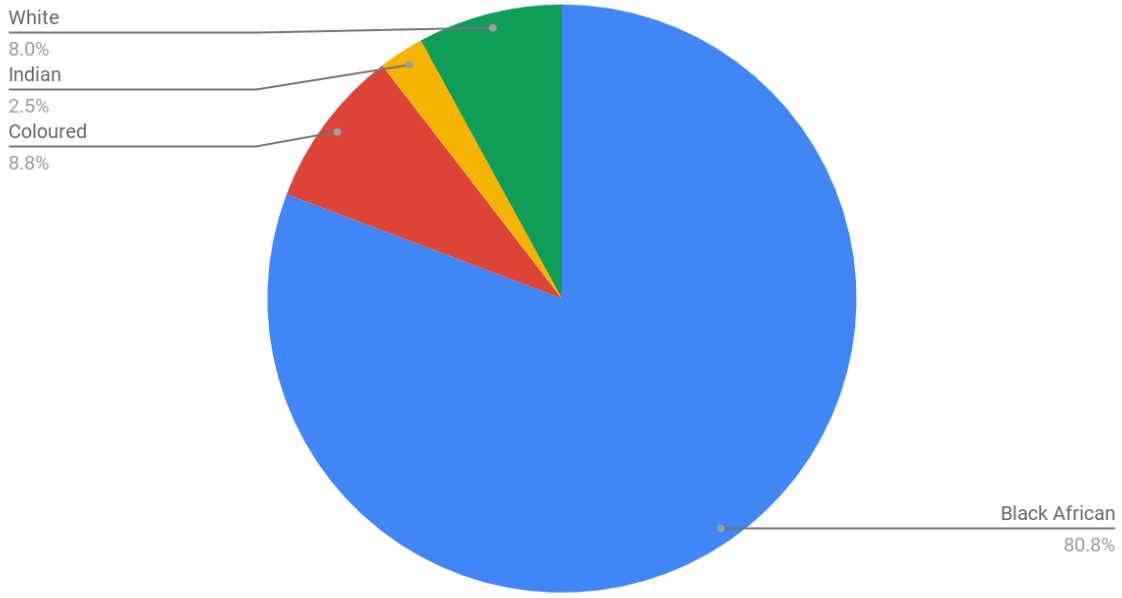
Sub-Saharan Africa, an arid to semi-arid region, is amongst the regions that will continue to face some of the harshest consequences of climate change, especially with respect to their water resources (Misra, 2014). It is therefore critical that this region re-evaluate its water management tactics and carry out programs that educate all citizens to better use their resources and to implement the effective conservation practices.

As a strategy of sustainable development, the concept of environmental education has played a pivotal role. Environmental education is an ongoing process of educating citizens about their local ecological assets and developing skills and attitudes toward the environment that are multidimensional and ones of unity (Rodrigues, 2014). Therefore, water education focuses specifically on the ways in which citizens interact with the water resources that affect them and those they have an effect on. The purpose of this education is to demonstrate how interconnected the ecological environment is to human society. Through water education, a sense of stewardship that is conscious of how one's actions affect the surrounding environment in the short- and long-term can be developed. Investigating water education strategies and analyzing how they can be improved will provide an understanding of how current practices are not efficiently using water as a finite resource, but rather as one that is renewable (Jabareen, 2006). This is critical as water has been considered a renewable resource by many scholars, but the rate at which it is being consumed has demonstrated that this resource has been abused to the point that it cannot replenish itself, leading to its depletion (Jabareen, 2006).

1.1.1 Durban's eThekwini Municipality

South Africa contributes to one of the geographically largest and second most populated continents on Earth (Statistics South Africa, 2017). In terms of population groups, South Africa's majority, known as the Black African, consists of approximately 80% of the country's population, as is represented in Figure 1.0 below.

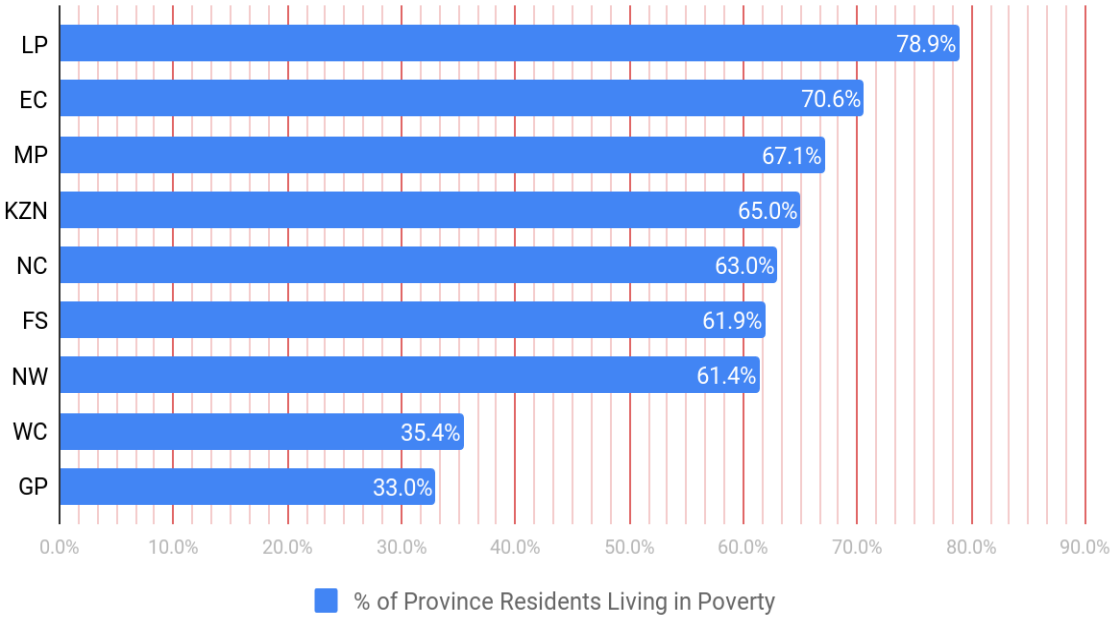
Figure 1.0: Distribution of Population Groups in South Africa



Source: Mid-year population estimates, Statistics South Africa, 2017.

When understanding the country's population groups in terms of their relationship with the state and the economy, it is critical to present the poverty levels of the nation as a whole. The following figure is a visual representation of the poverty level in South Africa by province.

Figure 1.1: Provincial Poverty Levels in South Africa

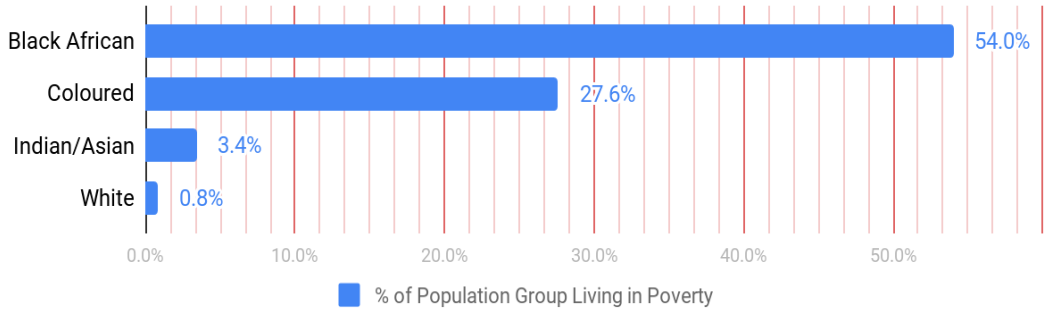


Source: Statistics South Africa, 2017.

To give some context to these numbers, below we see how they are then represented by separating the poverty rates by population groups. It is clear that within the Black African population, more than half

are living in poverty.

Figure 1.2: Poverty Levels Within Population Groups



Source: Statistics South Africa, 2014.

KwaZulu-Natal (KZN) is the second largest province out of 9 in terms of population size, with about 11 million citizens out of the country's 56.5 million (Statistics South Africa, 2017). As seen in Figure 1.2, 65% of KZN's population is living in poverty. The province's official languages, and most common home languages in their respective order, are isiZulu, English, isiXhosa and Afrikaans (Statistics South Africa, 2006). Additionally, KZN is the most diversity rich regions in the country, particularly due to the high level of moistness in this subtropical region (Minter, 2011).

Durban's population is approximately 3.5 million and has demonstrated consistent growths in the last decade (Statistics South Africa, 2017). Durban lies along the eastern coast of South Africa, within the province of KwaZulu-Natal and for the purpose of this study, recognized as the eThekwini Municipality.

The eThekwini Municipality is recognized as one of the most water abundant regions in the country, and up until 1983 water restrictions and conservation practices were not seen as a concern (The Civil Engineer, 1985). In 1982, significant water shortages and harsh weather patterns, including extremely high temperatures and lack of good rainfalls, prompted the formation of the Water Contingency Planning Committee (The Civil Engineer, 1985). The Committee acknowledged that the previous tactics used to conserve water, such as prohibiting the use of hosepipes and garden sprinklers, were insufficient and a reevaluation of the water management practices was required (The Civil Engineer, 1985). Speaking of the water scarcity situation of 1983/84, WJR Alexander explains that,

> [t]he present drought is extremely severe from a water resource point of view and far more severe than the droughts assumed for the planning and design of water supply systems in South Africa. … The financial losses to water users … have been minimal compared with agricultural losses and human suffering in areas which do not rely on large storage dams for their water supplies (Alexander, 2010:8).

Following this rude awakening and realization that the tactics being used did not suffice to sustain the water demands of the region, various other restriction strategies were placed. These include prohibiting the use of automatic flush urinals, washing motor vehicles only on the weekend and Monday's with potable water, and not filling pools with potable water (The Civil Engineer, 1985). It is evident that at this time, preventing overconsumption of water resources through the use of education, outreach, and public engagement is not considered to promote water conservation. Instead, the Committee formulated further water use and access restrictions to relieve water stresses (The Civil Engineer, 1985). As can be expected, water scarcity and stresses did not end in 1983 and continue today. However, post-apartheid South Africa has seen a shift in water management and outreach strategies.

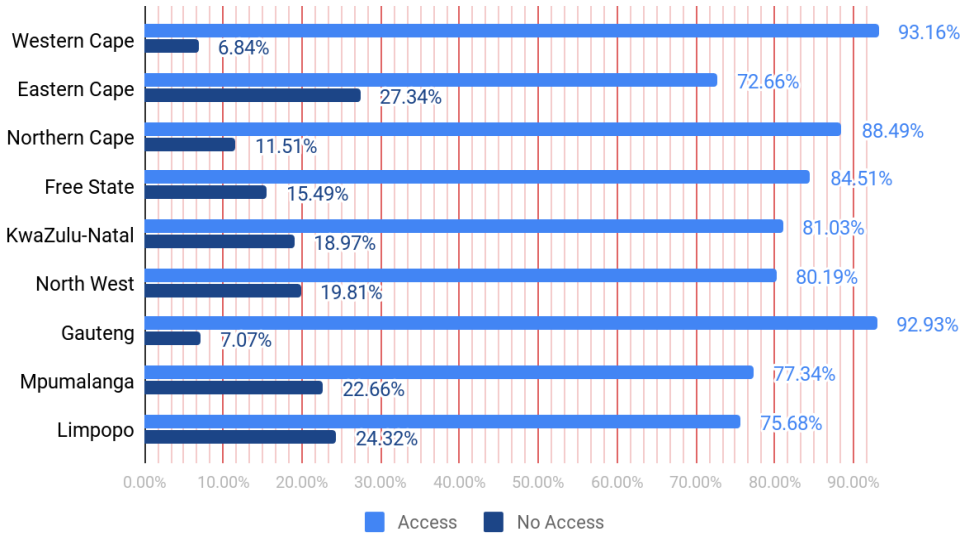
In 1993, South Africa established a new democratic regime, which saw the African National Congress (ANC) political party be elected as the new state governing body. This was significant for the country because it recognized the needs and rights of the Black African majority, who had been fighting for recognition and inclusion in the government mandate for too many years. Post-apartheid, the government was able to rewrite the Constitution to include these rights. Many struggles that were fought for at the time were the right to land and housing, after many Black Africans had been forcibly removed from their homes and/or relocated to the peripheries of their cities (Muller, 2013). Other recognition of rights that followed the post-Apartheid government was through the Bill of Rights that saw the provision of the National Water Act (NWA) and the Water Services Act (WSA), resulting in the right to sufficient food and water for all (Government of South Africa, 1996). The 1997 WSA's intention was to recognize the human right to accessible water and sanitation and placed accountability on all water servicing institutions to abide by these regulations (Republic of South Africa, 1997). The NWA established a mandate to protect and use South Africa's water sources in a manner that promoted the use of better management strategies, particularly for the purposes of preserving and restoring water (Republic of

South Africa, 1998). The key here, and the connection as to why Durban's eThekwini Municipality is so important, is that neither of these Acts provided specific details as to what 'basic water' entailed nor which management practices were to be carried out. In fact, it is important to note that prior to the policy of *free* basic water, the WSA still considered basic water to be a resource that needed to be paid for. Although the South African government eventually recognized the severity of the condition for its citizens and their need for basic services, it is the Durban local government that took the initiative to present free basic services to its people (Macleod, 2014). It is in fact eThekwini's department of Water and Sanitation, in 2000/01, who demonstrated how a predetermined amount of water as a basic right could be distributed to citizens for free; a strategy that was further used and implemented nationwide (Sutherland *et al.*, 2014). It is from Durban's example that the National Free Basic Water policy was developed, which introduced the intention to deliver 200 litres of water per day to each family or household (Macleod, 2014). After revision, eThekwini Municipality representatives established that 300 litres per day per family or household was more appropriate for the region's climate and circumstances (Macleod, 2014). Following these revisions, South Africa has committed to its citizens to continue to provide free basic services, including water.

Since the early 2000s, the various basic services that were promised to South Africans are seen as a great improvement in terms of recognizing the right to these services, but many South Africans are finding themselves without these resources largely due to the lack of service delivery (Tissington, 2011). With respect to water, the demands are not meeting the supply, water resources are being illegally taken and connected, the quality of water is slowly deteriorating, and water management tactics are being forgotten and lost (Herold, 2010).

Figure 1.3 demonstrates the percentage of residents in KZN that have access to safe drinking water from their household in comparison to other provinces across the nation.

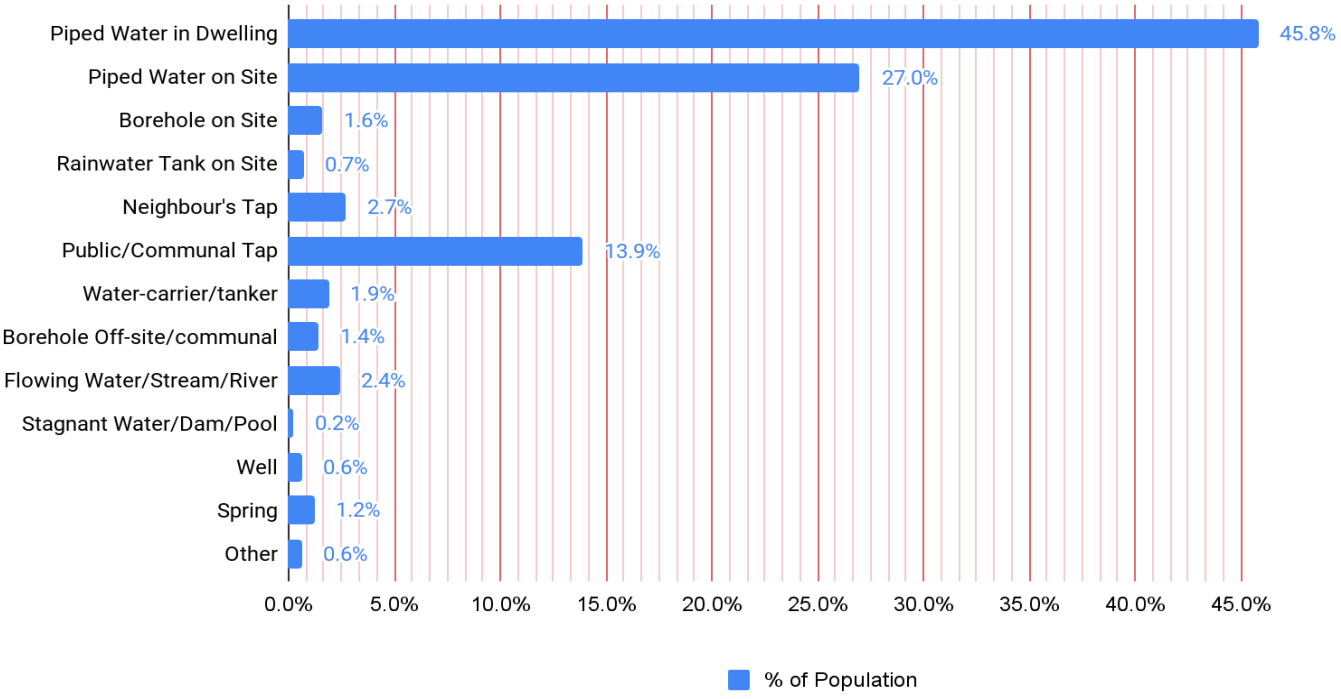
Figure 1.3: Poverty Levels Within Population Groups



Source: Statistics South Africa, 2016.

From these figures alone, it is evident that KZN provides safe drinking water to a large majority of its residents, approximately 81.03% of the province's population (Statistics South Africa, 2016). However, when comparing the distribution of water with proximity to the household, it is evident that the nation as a whole does not provide half of its citizens with water inside their residence. Figure 1.4 below represents how water is accessed by South African citizens, and perhaps provides some insight as to the root of the water accessibility conflicts that the nation is facing.

Figure 1.4: Main Drinking Water Source with Relation to the Household



Source: Statistics South Africa, 2016.

The current water education provided to residents of the eThekwini Municipality, through primary and secondary school curriculums and informal education formats, is assessed. Careful attention is paid to the outreach strategies being implemented by the Municipality and other public engagement initiatives. The use of the cognitive, asset-based, and participatory development approaches within formal and informal education settings is examined. Feedback is provided by UKZN students that have matriculated through eThekwini's formal education system. This is to reflect whether they believe that the discussed approaches were used or could have been used to enhance the water education received. Additionally, UKZN academics discuss if they believe that the development approaches have been effective in enhancing water education, their experiences as leaders and participants of informal education projects, and the value of the three development approaches within these settings.

1.2 Problem Statement

South Africa has one of the most plentiful natural resources in the continent and needs to implement more inclusive and strategic methods of education, especially with regards to water management. Through the evaluation of various approaches and the current education plan, this study attempts to produce strategies for more inclusive education practices that can enhance the awareness of water conservation, preservation, and the nation's water resources.

The reality of our society is that we are spending huge amounts of time and money on research and data collection to prevent the continuation of a problem, rather than understanding the root causes to prevent them all together. Through the use of education, various issues surrounding the world's water scarcity dilemmas could be prevented and avoided. Effectively executed education has the potential to save economies immensely, restore resources, ensure the conscious use of natural resources, and create a sense of stewardship toward the natural ecological environment.

1.3 Aim of the Study

The aim of this study is to analyse the water conservation education methods and practices and their effect on water usage in the case of Durban's eThekwini Municipality. The focus of this study is on eThekwini Municipality and the need for water education enhancement. Due to the increasing need for water conservation in this area, an examination of South Africa's current water education tools is conducted to understand why residents are not instinctively nor adequately conserving water. Additionally, I am determining the characteristics of each development approach that is being used to teach water education and which would be effective in conveying the need for water conservation.

1.4 Objectives of the Study

1. To assess the level of water education provided to residents from the eThekwini Municipality through primary, secondary, and public education forums.
2. To investigate which South African agencies are implementing water education in eThekwini and through which platforms.
3. To evaluate the effect of current water education methods and practices on water usage in eThekwini.
4. To determine the different sources of water education eThekwini distributes to residents and identify other sources that require active participation.

1.5 Main Research Questions

1. What is the understanding of water education by residents of the eThekwini Municipality?
2. How are South African agencies implementing water education in eThekwini?
3. What effect do water education methods and practices have on water consumption and usage in eThekwini?
4. What are the sources of water education which the eThekwini Municipality distributes to residents?

1.6 Significance of the Study

As previously discussed, the effects of climate change have major implications to the livelihood of all organisms living on Earth. Although the issue of climate change is creating a discourse that places emphasis on human activity, the damaging results of industrialization, and the evolution of modern society, it is critical to also consider how such degradation can be prevented. By enhancing awareness

and education of efficient and sustainable water management practices, communities can begin to implement strategies to successfully manage their water. This can then complement the ecological environment and create sustainable livelihoods. The purpose of focusing on preventative action is to not simply understand how human activity has caused the current environmental crises, but to take action to ensure that the causes are not replicated and the impacts are not exponentially intensified. Human population growth, modernization, globalization, and industrialization do not seem to be slowing, and with more people to account for, resource scarcity will correspondingly increase. By enhancing education on sustainable practices and strategies to manage our natural resources, there is a potential for the environmental shocks to be minimized.

The impacts experienced in semi-arid and arid regions due to climate change and water scarcity are quite severe. Examples of these are amplified by the consistent droughts and water shortages witnessed in Sub-Saharan Africa, particularly South Africa. KwaZulu-Natal is one of the most agriculturally productive provinces in South Africa and has seen major population growth; currently the second most populated province in the country (Statistics South Africa, 2016). As previously stated, the agriculture sector is the biggest user of water, so with the population increasing nationally and agriculture heavily impacting the province, it is critical for the nation's water sources to be better managed to ensure that these and other impacts do not completely deplete this essential resource. It is therefore crucial to evaluate water education strategies that are being implemented and how these can be improved. Assessing the current water education tactics will give an indication as to whether people are being effectively taught how to conserve water and whether these teachings are continued beyond the classroom. In addition, informal learning settings will provide residents with continued education, promoting the importance of water conservation. By focusing on development approaches that have proven to be effective in other aspects of resource sustainability, this study demonstrates how the transferable attributes of the cognitive, asset-based, and participatory development approaches can and have been successfully applied to current water education practices. Through this process, the suggested

adjustments have the potential to reach more members of both rural and urban regions through formal and informal education initiatives, therefore assisting in the preservation of current water resources.

1.7 Definition of Terms

Climate Change	is a "multi-faceted, and includes changing concentrations of greenhouse gases in the atmosphere, rising temperatures, changes in precipitation patterns, and increasing frequency of extreme weather events." (Gray and Brady, 2016:64).
Degradation	describes the decline of natural, ecological, and biological resources due to the inability to restore and reproduce that is either irreversible or cannot be replenished for a human life cycle (Johnson and Lewis, 1995).
Egocentric	is the concept that describes an individual's thinking as one that is only centred on themselves and their experiences (Piaget, 1953).
Freshwater	is water that comes from natural sources, such as rivers, lakes, groundwater, and so on, that is essential to sustain human life (Baron *et al*., 2002).
Globalization	the expansion of the global economy through international trading, financial, and investment platforms (Nayyar, 2003).
Industrialization	refers to the exponential increase in manufacturing and production for consumption through the use of technological developments and enhanced utility (Rasiah *et al*., 2015).
Invariant	is a term used by Jean Piaget to represent a mode of functioning that is "always present and does not change over time" (Turner, 1975:13).
Knowledge Integration	is using the participation of all members involved to promote the acknowledgement of the diversity within the community and assists in breaking down the power dynamics that may exist (Kindon and Elwood, 2009).
Pedagogy	is "the transformation of consciousness that takes place in the intersection of three agencies—the teacher, the learner, and the knowledge they together produce" (Cosgrove, 2016:176).
Poverty	relates to the inability to be a member of society that participates in the consumption of resources in order to sustain a dignified life, due to the lack of financial, social, and/or natural capital (Nolan and Whelan, 1996).

Sustainability	originated from the forestry sector, which referred to the practice of not harvesting more than the forest could replenish, therefore ensuring that the forest would continue to yield similar amounts in the future; this term has shifted in recent years and is applied to other contexts, such as economic and political issues (Kuhlman and Farrington, 2010).
Urbanization	refers to the movement of people away from rural areas into urban areas, such as moving from farmland to city centres (Chao, 2009).
Virtual Water	is used to refer to the amount of water in the global system that is used to produce and consume products that are traded as a commodity (Kumar and Singh, 2005).
Water Scarcity	refers to the shortage of water, which causes there to be insufficient water to combat social crises, such as the alleviation of poverty and starvation (Pereira *et al*., 2009).

1.8 The Study's Outline

Chapter One provides an introduction and background into the relevance of water as a resource and how the current strategies and results of mismanagement have impacted water significantly. Relevant information on South Africa, water scarcity in the nation, and some context of KZN and eThekwini is provided. The goals and expected results of this study are presented, along with an understanding of why this study is significant to the study of sustainable water practices and the development of sustainable livelihoods.

Chapter Two presents a theoretical frameworks that this study will attempt to use as a guide toward better water management strategies. The cognitive, asset-based, and the participatory development approaches are described in a thorough literature review. The significance of these approaches is discussed. The various tactics being used internationally, nationally, and locally are presented, as well as an understanding of the statistical data regarding water.

Chapter Three discusses the design of this study, outlining the research methodology, the sources of data collected, and the legitimacy of the information and data. Additionally, the analysis of these data sources is explained.

Chapter Four assesses the data collected and presents both the interpretations made from the collected data and what can be concluded as findings. Throughout this chapter I examine both student and academic interviews to understand what these two groups of locals believe the water education to be within eThekwini and how it can be improved. Additionally, interpretations from the data are made about current water education practices, both through formal and informal education sectors.

Chapter Five provides a discussion on the subject matter presented in Chapter Four, how the data can be interpreted and analysed, and what the implications of these findings are. Lastly, how this study can be continued and concluding statements to understand the impacts that this study can have are presented.

1.9 Conclusion

Chapter One provides an introduction to the relevance of water, the purpose of enhancing water education, and background of the efforts made by eThekwini residents to enhance water accessibility to all citizens. In addition, demographic information is presented to provide the reader with an understanding of the context of South Africa, KwaZulu-Natal, and Durban, with respect to population, poverty levels, number of people with access to water, and so forth. Lastly, the objectives and research questions of the study are provided, as well as the purpose, aim, significance, and outline for the whole study.

Chapter Two: Theoretical Framework and Literature Review

2.0 Introduction

For the purpose of this study, I have focused on the concept of water education, what it entails, and how it can be applied. The three development approaches, cognitive, asset-based, and participatory are evaluated with the intention of being used to enhance current water education. The theoretical frameworks most pertinent to this study are the Sustainable Development (SD) theoretical framework, as explained by Yosef Jabareen (2006), which is then supported further by the Education for Sustainable Development (ESD) framework that was developed by UNESCO (2017). By understanding the conceptual framework of Sustainable Development, the significance of education is expanded through the addition of ESD. The concepts of all three development approaches are then introduced to demonstrate their key characteristics and how they can be utilized to enhance the practice of water education.

2.1 Theoretical Framework

A theoretical framework is a conceptual outline that is used to provide guidance and support to a study. A framework provides context and demonstrates the logical direction in which a study will progress. For the purpose of this study, the Sustainable Development framework is used to further demonstrate the importance of water education and its relevance to global communities. As noted in Chapter One, Durban has been striving towards attaining high standards of water rights for all households; this has been central to many political and social discussions throughout the nation. With the use of the ESD, there are key components that can be expanded by eThekwini to continue its implementation of water management tactics and enhancing its conservation methods. With the use of the SD and ESD theoretical frameworks, I am able to demonstrate how the enhancement of current water education methods, circulated by the eThekwini Municipality, is critical in overcoming the water challenges faced by Durban residents.

2.1.1 Sustainable Development Framework

The Sustainable Development framework, as expressed by Yosef Jabareen (2006), consists of seven key components that have been assembled to create sustainable development. In an attempt to synthesize the various conceptualizations of the terms *sustainability* and *development*, this study focuses on the SD framework with the intention of exploring its application to environmental education and water conservation education. There are seven key aspects of the sustainable development framework that work together to formulate this theoretical framework. These are explained in the following section.

The Ethical Paradox

Jabareen (2006) explains that there is an ethical paradox that must be addressed to understand this framework, since the terms sustainable and development tend to contradict themselves, creating a paradox (2006). This is due to the contextual dialogue that follow the terms sustainable and development, relating to ecological protection and economic growth, respectively (Sachs, 2015.) The history of development theories and how they originated for the purpose of gaining economically, rather than expanding on social, political, cultural, or environmental progress is where the contradiction lies (Sachs, 2015). If the term sustainability refers to ecological protection and development originates from economic growth, then there is a paradox that arises when using these terms in conjunction. In addition, there is not a single agreed upon definition of sustainability, as the term has gained popularity in various fields therefore shifting away from an ecological context (Jabareen, 2006).

Natural Capital Stock

Jabareen defines natural capital as natural resources that cannot be created by humans, but rather modified and reproduced (2006). Within this capital, there are three main categories of natural capital that are examined; these are the non-renewable resources, finite renewable resources, and natural resources that can reproduce within a polluted and emission filled environment (Jabareen, 2006). For the purpose of this study, water is understood as a finite renewable resource. Water should therefore not be overused to the point that future generations cannot attain the same opportunities and benefits (Shen *et al.*, 2015). Should water levels be maintained to the point that it is not being overused, then it is

considered to be used sustainably (UNESCO, 2017). A key component to this aspect of the Sustainable Development framework is the understanding that there is no universal measurement for depreciation, which reinforces the need for better education and awareness strategies to prevent further degradation (Jabareen, 2006).

Equity

In this framework, the concept of equity relates to the intergenerational and intragenerational allocation of resources. Intergenerational allocation of resources describes the need to consider both current and future generations, to ensure that consumption is not depleting future generations' opportunities (Glomm and Jung, 2013). Intragenerational allocation of resources relates to the equality between societies and their ability to equally use available resources (Okereke, 2006). This concept furthers the understanding of sustainability by bringing to light the theory of ecological economics (Sachs, 2015). Ecological economics relates to a new way of thinking about progression and development, and the ways in which both ecological protection and economic growth need to be considered as equals for sustainable development to occur (Spash, 2012). This leads to the main aspect of ecological economics with relation to sustainable development, which is that without equal distribution of power and priority, the economy and environmental quality will not continue to grow together but rather one is be favoured over the other (Jabareen, 2006).

Eco-form

In terms of sustainable development, eco-form discusses the physical capital, such as infrastructure, human habitats, and urban spaces (Jabareen, 2006). The evolution of infrastructure under the Sustainable Development framework has seen ecological designs incorporated into the functionality of buildings, as well as the use of alternative and more environmentally friendly materials, renewable energies, and energy efficient appliances (Jabareen, 2006).

Integrative Management

The integration of environmental, social, political, and economic incentives when approaching development and growth is crucial to the Sustainable Development framework (Enger and Smith, 2013).

This aspect of the framework addresses the tendency to separate the economy, environment, and society when creating policies, despite the clear link between environmental degradation and poverty increases (Enger and Smith, 2013). Integrative management suggests effectively utilizing environmental concerns, the economy, and market incentives to develop policies that take the environment and economy into equal account (Jabareen, 2006).

Utopianism

Despite the radically different perspectives that many environmentalists and economists have of what a perfect society should be, the SD framework expresses the need to be reminded of the limits to both environmental protection and economic growth (Jabareen 2006).

Political Global Agenda

In addition to the previous six components of this framework, the political global agenda seeks to address the environmental and economic development conflicts that have been arising internationally (Jabareen, 2006). It is theorized that by understanding these conflicts at their root level, effective preventative measures and tools can be assembled to assist the developing world to decrease the levels of inequality (Jabareen, 2006).

2.1.2 Education for Sustainable Development Framework

In understanding the SD framework, it is important to note how education can play a role in achieving sustainable development. The Education for Sustainable Development framework and learning objectives identify the need for education within the environmental, social, and economic sectors and the need to incorporate all of these within one educational strategy (UNESCO, 2017). As the SD framework discussed, the transformation toward sustainability requires a complete shift in the way in which we compartmentalize and conceptualize the world around us. The concept of integrative management discusses the need to understand how our world, environmentally, socially, politically, and economically, is interlinked and the challenges imposed on the environment strongly dictate how the economy, and as a result our society, will shift.

The Education for Sustainable Development approach is considered to be a key instrument to the Sustainable Development Goals (SDGs). The SDGs are a set of goals that were created as universal targets by the UN, in order to eradicate global poverty (UNDP, 2017). Like the SD framework, the SDGs are interlinked and target 17 key aspects of global development that need to be addressed, improved, or reduced (UNDP, 2017). Examples of these are clean water and sanitation (goal 6), sustainable cities and communities (goal 11), responsible consumption and production (goal 12), and others (UNDP, 2017). The purpose of the SDGs is to implement clear targets and guidelines that each country should be striving toward, in order to unite and combat poverty and the environmental challenges that the world is currently facing (UNDP, 2017). The purpose of the ESD is to assist global communities to enhance their awareness of issues that surround them and to reconstruct the ways in which they relate to challenges their country may be facing, such as the deterioration of the natural ecological environment, social inequalities, and material overconsumption.

It is evident that education is critical in attaining sustainable development. The ESD approach focuses on ways to address the content and outcomes of current teaching practices, the pedagogy used to teach, and the learning environment in which students are taught (UNESCO, 2017). In addition to expanding the content being taught, the ESD promotes a transformative pedagogy that supports participation within the education setting, from primary to tertiary education, and within formal and informal learning environments (UNESCO, 2017).

As explained by UNESCO (2017), the ESD approach highlights cognitive learning objectives to achieve the sixth goal, clean water and sanitation. The cognitive learning objectives are particularly relevant to the study since they are assessed to determine which strengths and weaknesses could play a role in enhancing water education throughout the eThekwini Municipality. The ESD describes five key objectives that relate to cognitive learning (UNESCO, 2017):

1. Understanding water as a fundamental element of life; the quality and quantity of water, and how changes in either affect water pollution and degradation.
2. Understanding the importance of water as a part of numerous “complex global interrelationships and systems” (UNESCO, 2017:22).

3. Acknowledging the inequality in the distribution of and access to safe drinking water and sanitation.
4. Understanding the concept of virtual water, which describes water used in agricultural or industrial production. This is essentially water we are virtually paying for when purchasing commodities, because it makes up part of the production expense and uses.
5. Understanding key concepts of water management and strategies that ensure the availability and sustainability of water resources for food and sanitation. These include strategies used for flood and drought risk management, Integrated Water Resource Management, and so forth.

With the use of the Education for Sustainable Development approach, I am now able to thoroughly understand what aspects and key components of the cognitive, asset-based, and development approaches can assist the current education and awareness being provided regarding water conservation. It is evident that cognitive and participatory approaches are commonly used within the ESD approach, but asset-based is also be assessed as it provides context and reliability. This is because KwaZulu-Natal has a large agricultural and natural resource abundance, which could be useful when implementing asset-based strategies.

2.2.0 Literature Review

2.2.1 Water Education

Within the context of this study, water education addresses the teachings provided on how water acquisition works, how we use and affect water supplies, the consequences of (over)using water, and ways in which water can be conserved and protected. As previously discussed, the ways in which water is management and conceptualized needs to dramatically shift in order to sustain our natural resources both for present and future generations. In addition, the intragenerational inequalities also need to be alleviated, to ensure that all communities around the world have access to safe and clean drinking water. With this in mind, effective water education therefore serves as a long-term strategy to ensure sustainable development, particularly in transforming the conceptualization and stewardship toward water resources. Through understanding these key concepts of water education, I can determine how the three development approaches can successfully contribute to water education by further exploring the

prevention tactics that can be implemented under water education in eThekwini.

The Water Cycle

The first identified component of water education is understanding the global water cycle. In this component, the different states of water are discussed and the ways in which water is distributed are explained (UNESCO, 2017). This means understanding how water functions within different ecosystems and its importance to our atmosphere (Middlestadt *et al.*, 2001). Understanding the water cycle is critical as it demonstrates the interconnectivity that water has with all individuals, animals, and plants, and its vitality to the essence of life. By demonstrating the interconnectivity of water, one can then conceptualize how specific practices and daily tasks impact not just oneself, but also those within our surrounding. Lastly, the water cycle presents an understanding of the complexities of the natural ecological environment, how heavily it relies on our conscious practices, and how easily it can be impacted by the mismanagement of water sources.

Sources of Water

Learning about the different sources of water allows a learner to understand how vast water truly is, and yet how limited our access to potable water is. Discovering where water is stored in our natural ecological environment, groundwater, ocean water, aquifers, and so forth, assists in understanding the amount of resources used to obtain safe drinking water (Middlestadt *et al.*, 2001). From this, the different methods used to extract water resources can be examined, particularly when looking at the different forms in which water is manipulated and made available for human use (Middlestadt *et al.*, 2001). Lastly, this component of water education specifically relates to the concept of sustainable development and how sources of water are being over-consumed. This demonstrates how better management practices are necessary to sustain current and future generations (Jabareen, 2006).

Human Consumption of and Accessibility to Water

This section specifically explores how we relate to water on a firsthand basis, particularly through consumption. It is important for learners to unmask the realities in which countless communities around the world live in, both with plentiful accessibility to water and the other spectrum that sees a

complete lack of accessibility to clean and safe water (Williams *et al*., 2009). Through understanding the levels of consumption, the connection between water scarcity and the global need for enhanced conservation tactics can be established (Williams *et al*., 2009). The concept of conservation is gained by understanding the work and struggle that various communities go through to attain water and why they are in this position to begin with. From here, water conservation can be understood as an issue that affects everyone directly and the personal impact that every person can make.

Forms of Domestic Use

This component of water education follows the introduction of the water conservation concept. Learning about the domestic uses of everyday life demonstrates how simple tasks can use, and even waste water (Middlestadt *et al.*, 2001). By understanding the impacts that daily activities can make, learners can easily determine how to conserve water at home and how conserving water can directly impact them. Additionally, individuals are able to educate themselves on how to adjust their daily lives with simple changes that reduce their impact on water consumption and begin to conserve water (Middlestadt *et al.*, 2001).

The Larger Water Users

Teaching individuals this component entails demonstrating who the larger water users are, such as agriculture, residential, and commercial, both locally and globally (Williams *et al*., 2009). Additionally, this can assist learners to grasp how they are also consumers of virtual water, because the required resources needed to produce commercial products that are part of everyday life. Understanding the footprint that simple products can have and the lifecycle that they carry is crucial in enhancing the urge to conserve. Products require raw materials to be found, extracted, cleaned, transformed, produced, sold, transported, sold in retail, utilized, and then eventually thrown away; this lifecycle is one that few people take into consideration when buying and consuming products.

Water education, with all of these components taught in conjunction, therefore has the potential to strengthen an individual's and household's awareness of how our natural resources are being exploited, and how to prevent this from further occurring. By understanding how their actions can be

easily shifted, a learner is be able to implement simple changes to increase their conservation and decrease their impact, therefore working toward sustainable development.

2.2.3 Cognitive Development Approach

As the name suggests, the cognitive development approach is primarily based on an individual's perspective, thought, and the qualitative changes that occurred between birth and maturity (Turner, 1975). It takes a further examination of how the mind of an individual works and how it has been constructed to think a certain way. However, the purpose of implementing cognitive education is to look at the ways in which teachers communicate with individuals, rather than the individuals themselves (Ashman and Conway, 1997). For example, we look at how individuals are taught to conceptualize their surrounding environment, people, society, and how we all work together rather than focusing on why certain aspects of society are more successful than others. By understanding how and why individuals have learned to perceive objects and situations the way they do, there can be a further analysis into what has been prioritized throughout their education. If a community has placed more focus on working on a farm than working in an urban office space, an individual is more likely to have a stronger connection to farming issues than issues surrounding urban infrastructure.

To better understand cognitive education, we must explore some of the key concepts surrounding this strategy. Many researchers begin by explaining that the key component of how individuals conceptualize and compartmentalize what they have been taught or what they have observed is all stored in memory (Ashman and Conway, 1997). What causes one idea to be more memorable than the other is the impact that an event or teaching has had on an individual, the number of times it may have been repeated, or how early in the individual's childhood it is introduced (Turner, 1984). An example of this is the fear that stems from trauma such as the fear of being in small and dark spaces. From experience I can attest to the fact that only once in my very early life have I ever been stuck in a tight and small space, due to my own curiosity. This space did not place me in any direct danger and I never experienced it again, but due to the amount of time that I was entrapped in this space I continue to remember this experience and the negative association I have with small, tight, and dark spaces.

This development approach considers how an individual's mindset and their perspective about their surroundings have been structured and what principles and ethics have been prioritized. The cognitive approach can be attributed largely to Jean Piaget, who largely contributed to its development.

Cognitive Development: Theoretical Framework explained by Jean Piaget (1953)

Jean Piaget is described as a structuralist-organismic theorist who worked in the field of cognitive development (Flavell, 1977). Piaget theorizes that every human formulates thought and experience through an internal organization system, which stores experiences and knowledge within its own system of memory and thought (Posner, 1973). This represents an individual's form of cognitive functioning, which is considered to be invariant and shared by both infants and adults throughout time (Turner, 1975). The concept of invariant functions represents how an individual has developed through their interaction with their surrounding environment (Turner, 1975). Internal organizations, invariant functions, and contact with the surrounding environment are fundamental to an individual's cognitive development (Flavell, 1977). Turner refers to cognition as an individual's reaction toward the environment and the objects that function within, which are dynamic and interactive (1975). Intelligence on the other hand is an adaptation (Piaget, 1953). An individual adapts to the environment through action and "intelligence extends this creation by constructing mental structures which can be applied to those of the environment" (Piaget, 1953:3). Turner explains that the source of knowledge is action, and through action and contact with the environment is how an individual develops its knowledge (1975).

With the development of knowledge, Piaget explains that there are four main stages of development and functioning; these are sensori-motor, 0-2 years old, pre-operational, 2-7 years old, concrete operational, 7-11 years old, and formal operational, 11 years old - adulthood (Turner, 1975).

Sensori-motor: this stage is recognized as figurative learning, only being able to consider objects and situations that are immediately available to an individual (Turner, 1975). Infants at this stage is not able to interpret or conceptually transform the information given to them, but rather they react to their immediate environment. The infant internalizes the actions that it has experienced and these transform

into knowledge (Piaget, 1953). A child moves on from this stage once they are able to interpret action and gain the capacity to symbolize and express themselves (Piaget, 1953).

Pre-operational: operative development entails going further than just analyzing what is immediately available. At this stage the child is beginning to differentiate between perception and action (Turner, 1975). In terms of development infants at this stage are not fully considered to be logical, because they are still responding to their own experiences and are not able to go beyond what is immediately available to them (Flavell, 1977). This is why a child is considered to be using faulty thinking, since the thinking is intuitive in the sense that it comes from one point of view that is egocentric, not in a malicious way but rather simplistically and conceptually. (Turner, 1975).

Concrete Operational: at this later stage in development, children are able to have more interpretative and logical thought process, one that is less egocentric and fluid (Flavell, 1977 and Turner, 1975). The child is more systematic, is able to consider multiple perspectives when understanding a situation and decision making and is not as easily commanded (Turner, 1975).

Formal Operational: formal operations allow for previously developed cognition to include combinations and different outcomes of situations and circumstances as they begin to understand how variables in a situation can be interdependent of one another (Piaget, 1953). Due to this, a child can begin to think logically and apply rationality. As formal thought is created, cognitive development is completed, but Turner identifies the importance of recognizing that not all adults reach formal thought or complete cognitive development (1975). This means that not all adult thought is consistently formal.

2.2.3 Asset-Based Development Approach

The asset-based development approach is a strategy that was created as a reaction to the needs-based development approach (Mathie and Cunningham, 2003). The needs-based approach expresses the role of development as focusing on the aspects within a society that are lacking and ‘need’ to be developed. With the asset-based approach, there is an evaluation of the successes within a community, rather than evaluating their failures (Mathie and Cunningham, 2003). As a result, the asset-based approach is said to allow community members to feel a sense of power and belief in their abilities,

because they are realizing their potential through their success. This approach discusses the importance of community dialogue and input in development strategies, which are often facilitated by both local and foreign organizations and institutions (Kretzmann and McKnight, 1993).

Under the context of sustainable development, there are five main assets, also known as capitals that are considered to be important when evaluating the strength of individuals and communities (Scoones, 1998). These capitals, further explained below, are social, financial, physical, natural resource, and human (Scoones, 1998).

Social Capitals: the social resources and access that individuals have to support through their networks of communities and professional members, such as social networks and business colleagues (Scoones, 1998).

Financial Capitals: the economic and monetary gains and savings that are essential to sustain life and reduce vulnerabilities, such as savings accounts, cash, credits, and investments (Scoones, 1998).

Physical Capitals: tangible assets that are used for shelter and supporting livelihoods, such as land, houses, roads, and bridges (Siegel, 2005).

Natural Capital: the natural resources available to individuals to production and sustenance, such as soil, water, river flows, and crops.

Human Capital: the capability and functionality of an individual that allows them to use their skills and knowledge to engage in activities that increase their likelihood of success, such as the ability to work, to develop scarce skills, and the ability to read and write (Scoones, 1998).

Through combining the five main capitals, the asset-based approach attempts to evaluate an individual's or household's potential outcomes, in terms of well-being, and their opportunity for success (Siegel, 2005). In addition, this approach then analyses successful livelihood strategies to enhance the overall development of a community through policy changes and investment alternatives (Siegel, 2005). Through these policy reforms, a community is shown how they can and have succeeded, rather than focusing on the challenges within their community that they have not been able to overcome and their weaknesses that this then showcases (Mathie and Cunningham, 2003). This sense of success therefore

drives a sense of power in the local experts and community members, allowing them to see strength in their assets and capitals (Mathie and Cunningham, 2003).

2.2.4 Participatory Development Approach

Before explaining the purpose and meaning of the participatory development approach, also known as participation action research (PAR), it is important to note that this approach has three main strands and disciplines under which it is used (Lange, 2009). Within these, this study only be uses the participatory approach for the purpose of enhancing education on water protection and water conservation methods. The participatory method is often used in community development projects to create a collegial environment between stakeholders, researchers, local community members, and both foreign and local experts (Chambers and Balanoff, 2009). Additionally, PAR is commonly used within the international development field. For the purpose of this study, I am discussing the effects of participation within an education environment with the intention of learning and understanding the importance of water systems protection and conservation methods.

The participatory research method was created as a reflection of the development approaches that were primarily developed by northern countries, which did not represent inclusivity or recognition of the popular class and what they can contribute to the notion of development (Lange, 2009). The PAR is therefore an approach that enables the popular and working classes, also known as the locals in this study, to participate in their own development, (Lange, 2009). The participatory theory of development speaks to an inclusive learning space that encourages community involvement and communication, where individuals are prompted to learn from each other's experiences rather than a selected leader or educator (Cahill *et al*., 2014). This approach centres on the idea that individuals are more likely to learn and develop extensive knowledge when they are engaged in conversation and participating in relevant activities relating their personal experiences with the subjects at hand (Cahill *et al*., 2014). Additionally, students are motivated to speak of their own experiences which allows for them to feel empowered by their capability to express their knowledge and by the respect that is given to them, rather than the idea that they are meant to simply believe what the leader or instructor is teaching (Missingham, 2013).

Within this approach, there is also the idea of a moderator or facilitator as opposed to a teacher or lecturer (Missingham, 2013). This characteristic enhances the sense of openness that this approach attempts to implement, by encouraging participants to not feel as though they are being judged or graded by a teacher, thus allowing them to understand that they truly are the ones with valid knowledge and experiences.

2.2.5 Assessment of the Development Approaches

The evaluation of the cognitive, asset-based, and participatory development approaches serves as a tool to understand what characteristics, aspects, and combinations of these approaches could be used to implement successful water education. It is therefore pertinent to this study that the strengths and weaknesses of the three approaches are understood prior to determining their applicability within the different sectors of current water education practices. However, to stay within the scope of this study, I only discuss the top three characteristics of each approach that are seen as strengths and weaknesses, which relate to water and/or education.

2.2.5.1 Assessment of the Cognitive Development Approach

Constructive Characteristics of the Cognitive Development Approach

The cognitive development approach, as previously discussed, is heavily reliant on a teacher's interaction and communication with their learners rather than the learner's communication (Ashman and Conway, 1997). This component brings forth the first positive characteristic, which sees how implementing cognitive development approaches forces teachers to evaluate how they interact with their students and community members. Through personal evaluation, teachers are able to not only analyse their teaching practices, but also how learners react to their teachings. This is crucial for growth within a classroom and to allow for flexibility in the ways in which information and knowledge is provided to learners.

Secondly, it is critical to this study to acknowledge that a large component of all stages of cognitive development stems from an individual's reactions to their environment and how these are stored in their memory, and later compartmentalized. When enacting water education, cognitive

development provides a framework under which water resources can be used to give learners positive interactions with their environment and create positive memories. These positive memories could be helpful throughout the learner's life to relate to the environment and consciously enhance their water practices.

Lastly, using cognitive development for the purpose of education can allow teachers to evaluate an individual's relationship with the subject matter, influencing their reactions and imposing on their conceptualization of the lesson. With respect to water education, cognitive development can assist teachers with understanding why certain students may relate with and find interest in water conservation, whereas some may not. By understanding these components, teachers can have insight as to how to overcome past experiences that could be interfering with effective education, and/or how to create experiences that allow students to relate in a way that is long-term and effective.

Negative Characteristics of the Cognitive Development Approach

Although the cognitive development could lead to long lasting impacts if successfully implemented, it is challenged by how time-consuming this process could be, as cognitive development is a process that is carried out for many years (Flavell, 1977). This means that cognitive development and the ways in which a learner interacts with others and their environment should be considered throughout the whole education process. With respect to water, this could be problematic since students are bound to experience various teachers and environments that may not be conducive to water conscious teaching.

Additionally, it is important for the cognitive approach to have impactful and influential experiences. However, if students are at different stages of cognitive development, it can become difficult to continue teaching the same subject matter if there are students who are not grasping certain concepts. This challenge is common in multi-level classrooms, which "refer to the diversity of learners in terms of age, proficiency, learning styles and learner background" (Ashton, 2017:1).

Lastly, it is difficult to implement cognitive development within an education environment that all students and learners can relate to. Individuals have varying experiences, backgrounds, and ways of understanding different subject matter. It is therefore hard to implement one strategy that works with all

individuals. Kindon and Elwood give an example in which the students participating in their research project were not able to relate to the study as well due to their lack of relatability; “Students may be participating in a research project that focuses on issues, problems and places of which they have no prior knowledge or experience.” (2009:24). This therefore negatively impacts the success of implementing cognitive development for future conceptualization if a student does not initially relate with the subject matter.

2.2.5.2 Assessment of the Asset-Based Development

Constructive Characteristics of the Asset-Based Development Approach

One of the main characteristics of this approach is its focus on the strengths and positive aspects of an individual and/or community. By understanding the strengths that are held within the five main capitals, human, social, financial, physical, and natural, communities are able to gain a sense of their resilience and vitality toward success. With respect to water education, it is important for students to feel as though they are not being oppressed by a sense of lacking. Instead, they should be encouraged to believe that their knowledge, the natural ecological environment, and their social connections are fortifying their conceptual development and understanding of their resources.

Adding to the sense of empowerment and resilience, it is constructive for a community to have a sense of their durability through the assets that they have been able to attain and grow successfully. By appreciating their assets and understanding their value toward success, individuals are able to gain a sense of responsibility and mutual respect toward assets, particularly natural ones. Through this, the assets within a community are protected for current and future populations, leading to sustainable development. In terms of water education, individuals are more likely to sustain their water resources if they understand the value of these resources. If an individual is not exposed to the negative impacts that the mismanagement of water sources can have on their success, and more so their survival, then they are not be able to easily ideate water’s pivotal role in their livelihood.

Lastly, the asset-based approach is largely reliant on local community development, which implies a sense of reliance on local assets. Through the use of local assets, we can identify the last

positive characteristic that can be applied to enhance water education. In education, it is important for learners to be able to identify with what they are learning. This is clearly explained by understanding how cognitive development works; cognitive development theory tells us that individuals conceptualize and compartmentalize their rationale and logic through reactions to their immediate environment and experiences (Flavell, 1977). Therefore, it is critical for successful water education that learners are able to relate the discussed topics with examples that are relevant to their own life. For example, students are more likely to understand the severity of water scarcity in their surrounding area if they are able to relate to a local river that they have witnessed dry up over time. This would demonstrate to them the effects that water scarcity can truly have in the real world.

Negative Characteristics of the Asset-Based Approach

The asset-based approach relies largely on a community not only understanding their relationship with their local assets, but also having a sense of empowerment to manage these assets (Mathie and Cunningham, 2003). It therefore stands to reason to question how the role of the leaders and stakeholders of individuals and/or communities affect the relationship between locals and their assets. With respect to the natural ecological environment and consequently water education, if an individual does not feel connected to the natural ecological environment, because they do not have a sense of belonging within their community, then they are not likely to identify or relate with the efforts made to conserve local water sources. This characteristic is strongly relevant to the South African context, particularly due to the struggles with basic service deliveries; this is further discussed later on in this chapter.

The second negative characteristic of the asset-based approach relates to the dependence on a learner to relate the importance of water education with the success of their local assets. If a community is sustaining its success through the mismanagement and exploitation of its water resources, enhancing water education through the use of local assets as examples is not as successful as the local learner sees the mismanagement of water as a positive relationship for their success. It is therefore difficult to expand a learner's understanding of the need for water conservation if they believe that water

conservation leads to their failure.

This leads me to my last and final demonstration of how the asset-based approach could be unsuccessful in enhancing water education; what happens when there are not any positive water resources and assets to draw upon as examples? For example, if an individual has never been exposed to their local water assets, then it is difficult for them to gain a desire to conserve this hypothetical resource.

2.2.5.3 Assessment of the Participatory Development

Constructive Characteristics of the Participatory Development Approach

The first strength of the participatory development approach is its promotion of open dialogue and communication. The concept of open communication gives value to the knowledge of local members, encouraging their participation and interest, which enhances the concept of 'knowledge integration' (Schmelzkopf, 2002). Additionally, the participatory development approach exposes the various opinions within a community, their different perspectives and experiences, and the "depth of individual and collective experience that students bring … to share knowledge and useful learnings with each other" (Missingham, 2013:37).

The second positive characteristic of the participatory development approach is the interactive component, also known as experiential learning. "[E]xperiential learning occurs whenever the student is roused from the role of passive listener to that of active respondent, and it can be as simple as asking for a show of hands in class" (Hawtrey, 2007:144). Additionally, the purpose of this study focuses on the aspect of 'experiential learning' through active participation, which creates memories with which students can relate to and hold in their consciousness for a longer period of time (Hawtrey, 2007). Through understanding an individual's community and the different perspectives and experiences that are present, learners are able to further understand the dynamics that are guiding their community and analyse themselves and others with an enhanced sense of who they represent and what their place is within the community. In a student interview presented by Bozalek and Biersteker, a student explained that, "[t]hrough mapping my own community and the available (and blatant scarcity of) resources, I got

the opportunity to reflect on my community not only in terms of resources, but also communal ethos (including prevailing prejudices, attitudes towards gender, and even racism)" (2010:565). The interactive component of the participatory development enhances the self-awareness and reflection that is critical for an individual to understand the deeper levels of their situation and the situation of those around them, and how the surrounding environment has, can, and will be affected. This creates lasting memories that have the potential to influence the learner's consciousness, especially when they are actively participating in the learning process (Missingham, 2013 and Hawtrey, 2007).

Lastly, this development approach carries a characteristic of open communication and dialogue, all of which is meant to be facilitated and moderated rather than taught and lectured (Cahill *et al*., 2014). Allowing open communication to flow within the learning environment enables the learner to deconstruct the subconscious presence of power and control that may be attached with teachers and the learning space. Learners may feel more comfortable in expressing themselves when they believe that their opinion is not only important but encouraged. This shift in the power dynamic also allows for honesty to be expressed within a group of learners, which assists teachers and moderators to also learn from their peers about aspects of a situation that they may not have been formally educated about before. The value of local knowledge can therefore be expressed in a manner that is unfiltered and an understanding of how and why community members may or may not relate to their surrounding environment can provide insight as to what the true issues are. This can lead to real and progressive solutions to be formulated to combat some deep rooted issues that may not have been fully understood before.

Negative Characteristics of the Participatory Development Approach

Although participatory development garners various positive characteristics for enhanced education, there are a few weaknesses that must also be discussed. The first of which is its dependence on open dialogue and communication, which relies heavily on an educator's ability to relieve their power and control as the sole knowledge provider (Kindon and Elwood, 2009). Removing the education leader as the only knowledge provider is not necessarily the challenge of this approach, but it is the

leader's ability to engage others and remove control over the learners where the issue lies. If learners are not able to see the leader as a moderator, then they will continue to feel the pressures of being judged for their perspectives and experiences, which limits the level and quality of participation. Additionally, teachers who have functioned as the sole educator in the past may have difficulty with transitioning into a different teaching format.

The aforementioned negative component leads to the second characteristic that could create challenges when implementing the participatory development approach in the learning environment. When implementing this approach, there is clear dependence on open communication, which could become problematic when individuals are not interested or are unable to participate. There are two components to this challenge; one is the lack of interest to discussion and engagement, and the second is the lack of accessibility to education, which could intimate learners and prevent them from participating (Kindon and Elwood, 2009). If students feel as though they are not interested in the subject then it can be hard to engage learners with this approach. Furthermore, Kindon and Elwood explain that, "[s]tudents may be participating in a research project that focuses on issues, problems and places of which they have no prior knowledge or experience." (2009:24). When this occurs, the education facilitator reaches the challenge of being able to include all learners while still considering their levels of accessibility to education. If a circumstance arises where there are learners that are not aware of certain knowledge, it is important that there is openness and honesty to ensure that other learners are able to teach one another in a way that is not judgmental or demeaning.

Lastly, the amount of effort, time, and resources required to create an environment in which the participatory approach is successfully implemented within the learning experience can be extremely challenging for application (Schmelzkopf, 2002). Enforcing this approach within the learning sector could become too challenging due to the lack of access to resources or training. When considering the concept of water education implementation, the participatory approach would hypothetically rely on effective training for teachers and strong engagement within the learning community. Therefore, it is evident that facilitating training that give moderators the techniques and practices needed to engage

learners would be crucial, and the accessibility to ensure that this training is carried out could be limiting.

2.2.6 Water Education Provided by the eThekwini Municipality

In 2014, South Africa was praised by United Nations representatives, while participating in the UNESCO world conference on Education for Sustainable Development (ESD), for their progress within the education toward ESD (GCIS, 2014). With this momentum, the *Action Plan 2014* was implemented to continue the progress toward long-term improvements within the education system, with the hopes of increasing numeracy and literacy rates, higher quality of education, and early childhood development, among others (GCIS, 2014). In correspondence with the updated version, the *Action Plan to 2019*, the Department of Basic Education (DBE) states that they are taking into consideration the National Development Plan (NDP): Vision 2030 (2015). With this, the DBE aims to use the suggested timeline and guidelines to realign itself with the Sustainable Development Goals by presenting 27 goals to will increase the quality and medium- and long-term effects of the current education system (Department of Basic Education, 2015). With this, the DBE restructured and published the Curriculum Assessment Policy Statements (CAPS), in 2011, to represent the standardized requirements for education throughout the nation (Department of Basic Education, 2015). CAPS dictates policies for four different phases of education; these are the Foundation Phase, grades R-3, Intermediate Phase, grades 4-6, Senior Phase, grades 7-9, and Further Education and Training (FET) Phase, grades 10-12 (Department of Basic Education, 2015). It is important to note that these phases align closely with the four phases of cognitive development.

The Foundation Phase falls closely within the pre-operational phase, 2-7 years of age, the Intermediate Phase aligns closely with the concrete operational phase, 7-11 years of age, and the Senior Phase and FET Phase make up part of the formal operational phase, 11 years to adulthood. For the purpose of this study, the CAPS policies are evaluated to determine the water education that has been prescribed throughout the nation. This is the standard recommended by the KwaZulu-Natal's Department of Education, which consequently applies to the eThekwini Municipality (KZN Department

of Education, 2017). In this evaluation of CAPS, all grade levels are assessed to encompass the suggested water education subject matter, exercises, and intensity per grade level. The following Tables 4.0 - 4.4 present a summary of the water education that has been deduced from this assessment, per education phase.

The Foundation Phase

The CAPS package that is assessed for the Foundation Phase is the Life Skills module, as it is the module that presents concepts of water education and provides the most information regarding how water education should be implemented in this phase. Within this module discussions on water as a main topic is recommended under CAPS, which provides information on common uses of water, how humans and other organisms that rely on water, and the concept of saving, using, and storing water (Department of Basic Education, 2011a). It is important to note that there is a comment within this package that identifies that teaching the water cycle at this phase is not necessary, but rather the concept of water as a resource is introduced.

The Intermediate Phase

Under this phase, the Life Skills, Natural Sciences and Technology, and Social Sciences modules contain relevant information pertaining to water education. Topics discussed in these modules include the subjects of health and environmental responsibility, the importance of water and water quality, understanding how plants require water as a component of growth, and the different habitats that animals and humans use and how these are used for shelter and survival (Department of Basic Education, 2011b). Additionally, the water cycle and the different states of water are explained, the interdependence of resources among humans and animals, understanding water as a resource that is used alone and in combination with others, such as soil and sunlight, and how these resources and their availability can be affected by overuse and mismanagement (Department of Basic Education, 2011b). Lastly, the South African water concept is introduced in grade 4, which is continued throughout this phase by understanding how water plays a key component as a natural resource and within the mining and mineral industries (Department of Basic Education, 2011b).

The Intermediate Phase is the first time that geography is introduced as a topic, which furthers the understanding of water as a concept of the ecological cycle.

The Senior Phase

In the CAPS policies found for the Senior Phase, the Natural Sciences and Social Sciences packages presented relevant education recommendations that pertain to water. Some concepts further the understanding of water as a natural resource, how it is used, how it can be used sustainably, the concept of sustainability, water management, and who the users of water are and the varying sources of water (Department of Basic Education, 2011c). Additionally, the notion of water conservation is applied within this phase. Lastly, water is used to understand other concepts, such as boiling points, chemical reactions, the consequences of poor waste management and over-pollution, renewable and nonrenewable energies, the movement of water in relation to space and the moon, expanding on plants and their growth through photosynthesis, and the movement of light through different mediums (Department of Basic Education, 2011c).

The FET Phase

The FET Phase of the South African standardized curriculum is a key aspect of the learner's education structure as it is the final phase that students need to complete in order to matriculate. In this phase, students are required to take at least 7 courses, of which 4 are compulsory and 3 are electives, from a selection of 30 options. Of the compulsory modules, Life Orientation is the only CAPS package that provided some insight into the water education that is provided. Within this package there is a social issues section that discusses basic service delivery and the challenges that are faced with water delivery and water and sanitation (Department of Basic Education, 2011d).

When evaluating the 30 electives for students in this phase, there are 5 main topics that are assessed that summarise the main aspects of water education that are discussed and recommended; these are Agriculture, Economics and Consumerism, Geography, and Life and Physical Sciences. These modules suggest teaching the uses of water for agricultural purposes, water management practices, ways in which water is wasted, sustainable water use and consumption, water as a natural resource and its

effects on land use, and how water is used to attain electricity resources. Lastly, the concept of flooding and other natural disasters that affect South Africa are discussed, drainage systems, how populations affect water sources, the reiteration of water as a source for plant growth, water availability, water quality, water pollution, and the chemistry of water are discussed (Department of Basic Education, 2011d).

2.3 Gaps in Research and Resolution

I have found a need to increase water conservation awareness throughout the Durban community, particularly due to the presence of constant drought notices and the calls for reduction in water usage. Many politicians, such as Ednick Msweli, have expressed their disappointment in resident attitudes toward water conservation, particularly using these 'attitudes' as a reason for why water continues to be a scarce resource in the eThekwini Municipality (Mlambo, 2016). The lack of interest taken by government officials to understand why these attitudes exist is a clear gap in the successful implementation of water conservation strategies. I believe that the link between water scarcity and water conservation lies within the divide between implementation tactics and proper education and awareness of the need for water conservation. Due to these gaps, I have found a limit in the amount of research that discusses the level of water education distributed among members of the eThekwini Municipality. This information is relevant in order to understand why current water conservation practices are not as effective as expected, and how they can be improved with further education. In order to resolve this lack of research I aim to review current education programs, understand how many of these provide information on water, and determine what water education is being taught.

2.4 Scholarly Perspectives

In understanding the context of this study and how it compares to other work done on this topic, it is important to understand the work that other scholars have presented both nationally and internationally. In a study presented by Bruce Missingham in Australia, the strategies and pedagogies

used for water education are discussed. In this study, Missingham explores the effectiveness of "asset-based teaching … participatory learning … and involving students in [the] construction of knowledge" in the higher education system (2013:34). Missingham acknowledges that there are dynamics of power and inequality that are present within schools and universities, therefore expressing that the use of participatory learning and other popular education strategies must be assessed before implementation. In addition, Missingham recognizes the importance of shifting the mindset of a learner toward water awareness and the need for consistent involvement in water conservation for continued cognitive development (2013).

A study that focuses on the effects that water scarcity has had in South Africa notes that there is a distinct difference between those who live in rural versus urban regions and their relationships with water (Duse *et al*., 2003). Additionally, these scholars find that to improve hygiene and sanitation, it is critical for the enhancement of education, in relation to water, to be enforced. The intervention for better water management practices and awareness is considered crucial for the development of South Africa (Duse *et al*., 2003).

Investigating the relationship between the South African communities with their environment, Sherwill *et al*. find that people of the Sabie catchment, in Mpumalanga, are well aware of their dependence of their water resources and how crucial they are for their survival (2007). However, despite finding that the majority of communities in the study area have a strong sense of the surrounding environment and their dependence on the water resources, Sherwill *et al*. find that the community of the Sabie catchment is not concerned or bothered by droughts and periods of water scarcity, as they strongly believe that the water will always return to its normal level irrespective of the crisis at hand (2007). When studying the community of the Sand River, Sherwill *et al*. find similar results in that the community is also very connected to their river and dam. In the study, it is explained that when the Injaka Dam was completed, many speculated that conflicts would arise between local residents and stakeholders who were disagreeing about the best management practices of this water; if it should be used for domestic purposes or if it should be conserved (Sherwill *et al*., 2007). Sherwill *et al*. also

discuss the presence of inequality between community members and stakeholders and how these imbalances impose on the ability of community members to make decisions, despite using the participatory approach.

In a different scholarly article discussing the awareness of water and water pollution amongst South Africans, the complexities that arise amongst different population groups when assessing their water awareness and behaviours toward water is assessed and discussed (Anderson *et al*., 2007). This study finds that due to the long history of power struggles in South Africa, the majority of the African population in South Africa has been primarily concerned with the accessibility of clean and safe drinking water, rectifying water and sanitation challenges, and acknowledging how these difficulties have been directly affecting the environmental quality of the state (Anderson *et al*., 2007). In bettering the water management practices, Anderson *et al*. find that the connection with the environment is much stronger within the lower-income population, as they are mainly isolated to rural areas (2007). They also find that enhanced education positively correlates to active participation in water conservation and protection (Anderson *et al*., 2007). Anderson *et al*. also assert that when in more rural areas, water scarcity and management are seen as community problems and therefore the responsibility of all those within the community to rectify them (2007). Through these, communities are strongly aware of their assets, the potentials that they have, and the benefits that they gain by having strong participation when conserving and restoring their water resources (Anderson *et al*., 2007).

In a case study carried out by the eThekwini Municipality in 2007, scholars find that using a resource-based approach also facilitated in water education improvements (Hoffman *et al*., 2007). This study assesses teachers that enrolled in a sustainability program as part of a professional development initiative that was started in Durban. Through this study it is found that many teachers are using their resources to guide their teaching by using an outcomes-based approach, rather than implementing the resource-based approach that was being promoted (Hoffman *et al*., 2007). Additionally, they found that "[w]hen learners are restricted to using what they already know to try to make sense of new experiences, the potential to learn from anything new and to challenge the validity of what they already know can be

limited, and may be inadequate for making good sense of new experiences" (Hoffman *et al*., 2007:9). In essence, this study finds that it is difficult for teachers to introduce new concepts to students if the students have not experienced these concepts before in an earlier stage of cognitive development and are therefore being unable to grasp or relate to the subject matter (Hoffman *et al*., 2007). It is therefore suggested that these concepts be introduced and continually introduced throughout all stages of the education system (Hoffman *et al*., 2007).

2.5 Conclusion

In this chapter, I discuss the Sustainable Development framework that encompasses the study of water education in this research. The Sustainable Development framework is then further supported by the Education for Sustainable Development framework, which assists in understanding how education can encourage progress for sustainable development. A literature review is carried out to understand the context of water education and the concepts of cognitive, asset-based, and participatory development, and how these are applied in this study. Lastly, perspectives from other scholars, both international and domestic, are presented to understand the context in which water education has been studied and how the three approaches were received when applied to teach water conservation.

Chapter Three: Research Methodology

3.0 Introduction

The aim of this research study was to evaluate the current water education provided to the residents of eThekwini Municipality through the standardized education system, government engagement strategies, and through active participation. In doing so, this study attempted to understand how these education tactics can be improved and enhanced with the use of cognitive, asset-based, and participatory development approaches. Expanding on the literature reviewed in Chapter Two, a qualitative research method and techniques were employed to frame the strengths and weaknesses of each of these approaches. Student perspectives were sought to give feedback they remembered having been taught with the use of cognitive, asset-based, or participatory approaches before and if they thought that using these approaches can assist in teaching water education. As John A. Centra explains, there is no better approval of an education technique that can be gained than from that of a student, especially as they are the ones that can interpret their peers' and teachers' successes and downfalls within the teaching environment (2003). Therefore, to determine the effectiveness of the suggested results, both students, who have experienced primary and secondary education in eThekwini, and academics of UKZN were interviewed. These interviews served the purpose of providing useful opinions of how these approaches can be further used and employed by eThekwini to increase the quality and quantity of water education. To validate this study, this chapter presents the research design, ethics, and a thorough explanation of the study's subjects and area.

3.1 Research Design

This study has been implemented by utilizing a qualitative research method. The theoretical framework of Sustainable Development is explained and further supported by the Education for Sustainable Development framework. A literature review on water education is carried out to declare the concepts that must be considered under the context of water education and what topics must be taught.

Furthermore, information provided by the Municipality is examined and discussed to determine if there are characteristics of the three development approaches used within the current tactics. In doing so, the current standardized curriculum that is mandated throughout the country is examined.

Moving forward with the literature review and the knowledge therefore attained, I interviewed 10-15 students from UKZN's Howard College, in a face-to-face semi-structured format. The purpose of these interviews was to understand what students believe is causing the droughts in our region, why water conservation may or may not be necessary, and to understand what actions they take to conserve water. I also intended to understand what information they have received, as elementary and high school students, regarding water conservation, environmental awareness, and/or sustainable water use practices. To join this research, I aimed to conducted 10-15 one-on-one interviews with educators at UKZN, also face-to-face semi-structured, to understand their experiences implementing conservation awareness, particularly to do with water, to locals who reside in the Durban area. This was done to see how these educators believe the local education has affected the understanding of water conservation practices and the educator's ability to conduct such initiatives. From these one-on-one interviews, I gained a more concrete understanding of what students believe is imposing on their education of water conservation methods, how to combat these obstacles, and a comparison of these findings with that of the UKZN staff members.

I evaluated the South African national curriculum to determine the education that is being provided to the youth from schools, as a requirement from the government. To do this, the Republic of South Africa's release Curriculum Assessment Policy Statements (CAPS) were reviewed, as these statements outline the standards of education for the entire country, in terms of topics to teach and a structures on how much time to spend teaching them. These are readily available online.

3.2 Study Area and Population

This study was carried out at the University of KwaZulu-Natal (UKZN), Howard College. UKZN was formed in 2004 when the University of Durban-Westville and the University of Natal joined

as one (UKZN, 2017). Howard is one of the five campuses that now exist at UKZN. Since both students and academics of Howard College took part in this study, as voluntary participants, one-on-one interviews took place on Howard College at a common meeting place. The majority of students were able to meet at one of the Development Studies offices, on the 7th floor of the Shepstone Building. Academics either met me in their offices or at a common meeting place in the Shepstone Building.

3.3 Data Sampling and Collection

To conduct this research and attain the qualitative information through interviews, I implemented a purposive sampling strategy with a focus on homogenous sampling. This is because I was looking for students with similar characteristics in their levels of education; above the age of 18, having completed elementary and secondary education, having been enrolled in the Durban education system, and have some awareness of local issues. Accordingly, the educators selected in this study to take part in interviews also present a higher level of education and have experience working with local residents and students. As explained by Earl Babbie, purposive sampling is appropriate for this study because the nature of this study required me to speak directly with eThekwini residents who have experienced the education system (2001). The homogenous sampling represents this population, as they carry the same characteristics previously mentioned. As this research was qualitative, the results from these interviews were not weighted since the information gained is not being used to represent the entire Durban population, but rather to gain some understanding as to what the existing challenges are that are interfering with water education. In addition, the interviews discussed how the three development approaches could potentially be used to enhance this education. The inputs gathered are useful to other scholars who are working in this field of water education and increasing awareness of water conservation practices.

For the selection of participants, I implemented the self-selection strategy, in which candidates chose to participate in the study voluntarily. Participants were made aware of the study through the publication of the participation requests that were submitted through the UKZN Notices System.

Participants then chose to participate if they felt that they met the criteria. I indirectly promoted the invitation to participate with the help of Student Notifications, emails circulated by UKZN. If I did not get sufficient participants or qualitative data, I approached UKZN academics who worked in the environmental or development field for interviews by meeting directly in their departments. Through my discussions with them, they then decided if they wanted to participate in the data collection portion of my study, as a volunteer participant, or not.

3.4 Data Analysis

As this study heavily used qualitative analytical techniques, such as content analysis, mirror analysis, and substantive significance, the literature used is mainly secondary peer-reviewed sources. Other information gathered through conversations with students and academics from UKZN is also qualitative information, as it represents the opinions of those individuals that chose to take part in the study. As explained by Patton, the use of the convergence and divergence techniques to determine which interviewees gave similar and dissimilar responses, respectively, mirror analysis to categorize the information provided both through theory from literature and through data collection from interviews (2002). Additionally, the use of the substantive significance technique allowed for the triangulation of the data attained that supports this study's findings, and enabled me to determine "how solid, coherent, and consistent is the evidence in support of the findings?" (Patton, 2002:467).

For these reasons, this study is to be based on the interpretivism paradigm. This is because the questions being asked in this study are answered through various forms of qualitative information and research, which has been analysed and interpreted as relevant or irrelevant to the study by myself, the researcher. As my educational and personal experiences are different to others, what I perceive to be relevant or irrelevant may differ from others. Bucci explains that the perspectives of a researcher do not hold an absolute truth, but rather a truth to the researcher and the work that they present (2002). Additionally, I agree with the claim that Bucci makes with regards to bias, as I have a bias towards implementing stronger water education practices, due to my background in environmental sciences and

natural resource management (2002). Although I have limited a bias throughout this study, especially when speaking to student and academic participants, there is no way to completely eliminate bias. I also emphasize that my bias toward the need for increasing water education awareness and water conservation practices is what drives my passion and interest in this study, and I therefore believe that this bias is a strength for this study.

3.5 Ethical Considerations: Validity, Rigour, and Reliability

Validity

The qualitative information gained through discussions with participants is primary data that is collected, interpreted, and evaluated with accuracy. To ensure the validity of this study, I have gathered information that is relevant to my theoretical framework. Any theories or conceptual understandings that I present are current and academically sound. Additionally, I have worked toward reviewing the credibility and validity of the authors and key players within this study. I have ensured that all participants acknowledge their part in this study, how their perceptions and ideas are used, and I have provided the necessary confidentiality to certify that all are comfortable with their impact in this study. Lastly, I recognize the importance of not influencing the conversations with participants, which consists of not guiding their answers or thoughts. This is done by presenting open-ended questions that do not suggest a direction towards one answer over the other.

As previously mentioned, one-on-one interviews were conducted with students and academics of the UKZN Howard campus. This campus is the largest and most central to Durban. Although these results cannot be seen as conclusive and cannot be generalized beyond this population group, it delivers relevant information and insights that can provide assistance to others working in the water education field. I have additionally kept audio recordings of interactions for validity purposes and have continued to consult with my supervisor to ensure that the instruments and procedures conducted throughout the research are effective and valid.

Rigour

To ensure the rigour of this study, I employed a strategy that portrays trustworthiness, which is established by displaying credibility, confirmability, transferability, and dependability. Manual analysis has facilitated transparency in the interpretations made from the literature and interview material (Sinkovics *et al.*, 2008). Credibility is established through the use of development approach theories, which are well formulated, heavily compared and analysed, and have been extensively used throughout various practices. With respect to confirmability, I have demonstrated that participants are not being guided in the study (Sinkovics *et al.*, 2008). Data collected and the interpretations made by myself, the researcher, are logical and rationalized through theory and are not guided by my beliefs or biases. Dependability, like reliability below, is demonstrated through the use of various academic insights and critiques, to ensure that the work produced is relevant and well-researched, and that the material gathered is unbiased or weighted.

For the purpose of this study I have provided various references and fact-checked any data that I have presented. There is an in-depth study carried out to fully master the key concepts of all three development approaches, and through these analyses there is a thorough comparison of how these apply to water education. To do this, I conducted an intensive investigation of the evolution of the water education framework, while considering the history and challenges that have been overcome. By recognizing the full context of this framework, I am able to analyse how certain challenges have been combatted and why other challenges in water education continue to pose a hindrance on the impact that water education has the potential to create.

Reliability

I believe that this study is highly reliable due to the tactics used throughout. By conducting a literature review that is inclusive of all strengths and weaknesses of not just the development approaches, but also the theoretical framework, I present academic work that is meticulously researched. In addition, I have consulted with various academics within the University of KwaZulu-Natal to ensure that the findings that I am proposing are also guided through academic expertise and experience. There

are numerous academics within the School of the Built Environment and Development Studies that specialize in community-based projects, water conservation and education, as well as various development approaches. For the purpose of this study, my supervisor,

Prof. Oliver Mtapuri, has assisted by guiding me for the duration of this study by reviewing my progress, offering suggestions and comments, and critiquing any part of the study that may not be sufficiently relevant, reliable, or thorough enough. I believe that with the use academically sound research documents, a rigorous study, combined with documented consultations with both academics and professionals, I am in a position to present an accurate and reliable dissertation.

All participants that took part in face-to-face interviews are voluntary participants, as they were indirectly recruited through UKZN resources and notification systems. Confidentiality and anonymity is determined through a consent form that both the researcher, myself, and the voluntary participants have signed. In this form, it is clearly stated that they are aware that their information will not be distributed to outside sources, and only their major and the year they graduated secondary education will be published, as well as their answers. I have also stated that the participants have given consent to have their responses and dialogue recorded through audio recording only, and that no visual and photographic material has been obtained to ensure anonymity and comfort. Additionally, I have also expressed the intent to ensure the participants' safety and have worked to produce a study that did not cause any harm to research participants. This is done by holding face-to-face interviews in seminar rooms and offices, within the UKZN campus, during daylight hours, and with respectful participants. These characteristics have established a safe environment for respondents to engage in discussions.

3.6 Scope of Research Limitations

This study analysed the perspectives of a small number of students of UKZN for the purpose of assessing their firsthand experiences within the formal education system. This study was not embarking on finding conclusive results about the education system, but rather to understand how successful students believe their education has been and how it could have been improved. UKZN staff members

were interviewed to understand their experience within the teaching environment, both in formal and informal settings, and to determine how the three development approaches have been used and continue to be used for the purpose of providing water education. Since this was a qualitative study, it was not the number of students that were interviewed that was important but rather the quality of responses.

In addition, this study focused on citizens of the eThekwini Municipality, as it has been proven that this region has largely been representing issues surrounding water accessibility and availability, and therefore provides critical information needed to enhance water practices.

3.7 Conclusion

This chapter has provided an outline of the research that has been conducted, the methodology used, and the steps taken to ensure the validity and reliability of this study. The methodological approach employed is presented, which details the sampling method, analytical process, and other techniques employed to ensure that the study maintains its integrity. Lastly, the boundaries of this study are discussed and supported.

Chapter Four: Findings and Interpretation

> "Environmental education is about *the impact of the lifestyle choices we make*, about the decisions we take that affect the air we breathe and the food we eat. *We have a responsibility to teach our future adult citizens* to make better lifestyle choices not only for themselves but also for their families, their local communities, and in the end the global biophysical environment that *forms the foundation of our existence*." (Pandor, 2005)

4.0 Introduction

Through qualitative research techniques and one-on-one semi-structured interviews, this chapter aims to present the empirical report that is deduced from the previously discussed fieldwork. The purpose of this chapter is to provide some insight to answer the study's research questions. This chapter therefore provides data to answer the following questions:

1. What is the level of water education that residents within eThekwini Municipality receive?
2. How are national agencies implementing water education and what are the resources?
3. What effect do current water education methods have on water conservation and usage in eThekwini?
4. How can the three development approaches be used to enhance water education?

In understanding how the three development approaches are best used to carry out water education, the education itself pertaining to water conservation and awareness is evaluated within the context of the eThekwini Municipality. This is done by assessing the current environmental education programmes, packages, and instructions that are distributed through local, provincial, and national government levels. Within these, there are different materials distributed within both primary and secondary education, as well as the various activities that are carried out.

The overarching purpose of this study is to evaluate if and why certain development approaches have proven to be effective in the implementation of water conservation education. Once an understanding of the levels of water education that are currently being distributed to eThekwini residents

is attained, I present how these levels are reflected by the perspectives of both students and academics of UKZN, Howard College.

One-on-one interviews were conducted with UKZN students to understand what they believe their level of water education is and how it has been received, through formal and/or informal education. These students were all educated within eThekwini. The map below, Figure 4.0, is a visual representation of their school locations, with the larger red circles representing more than two students attending the same area, the medium circle represents two students, and the smaller red circles representing one student.

Figure 4.0: School Distribution of Student Participations

Source: Google Images, 2017.

Additionally, UKZN academics of Howard College were interviewed in one-on-one interviews to gain an understanding how they believe locals and students receive water education and their relationship with their surrounding environment. Since these academics were all members of the UKZN

staff community at Howard College, a map to represent their workplace was found not to be necessary. Students were also identified by the year they graduated secondary education, to give some insight as to how recently they had been enrolled in secondary education. To ensure anonymity, participants were not listed by name but rather by their subject of expertise. Academics are further identified by their position in the university to differentiate those who may have a similar specialty. A list of the participants and their code names can be found in Appendix One. The interview guide for staff members can be found in Appendix Two and the interview guide for students can be found in Appendix Three.

The perspectives provided by students serve to understand the experiences of eThekwini residents in the formal education system. Academics provide insight into the education and work done within local communities and how this work can be positively influenced by the cognitive, asset-based, and/or participatory development approaches. A thematic approach is used to analyse the data and this evaluation is expanded in this section.

4.1 Understanding the Level of Water Education

4.1.1 Student Perspectives

Before discussing the student perspectives that are provided by UKZN students, it is important to note that this information is not conclusive as the number of participants interviewed is not representative of the whole student body, but rather guides an understanding of how water education has been gained by some current students.

Although it is evident that the standardized curriculum practiced within eThekwini Municipality does show concepts and content relating to water education and presents a sense of priority in teaching water, there is one question that still remains: Is the mandatory water education that is taught through primary education effectively teaching individuals about water in a way that allows for these concepts to remain with them beyond primary and secondary education?

One participant, when asked who they believe has provided them with the most water education, explains that the majority of this education has been taught to them in primary school, with concepts

such as cleaning dirty water, saving water, and so forth. These concepts are evidently components of the third and fourth stages of water education that is previously discussed in Chapter Two; importance and uses of water for human consumption. However, when asked what they believe has impacted their water consciousness up to that day, the same student explain that they had taken an interest in the concepts of environment and water and had therefore chosen to take Geography in secondary school. This student provides the following explanation:

> *I think it's because I did geography (2012-2014, elective, from grade 10-12). So I'm aware of water and how we don't have water in South Africa. And I'm trying my best to conserve water and I'm well aware of the whole drought issue.* (Social Work, graduated secondary education in 2014, 2017).

Alternatively, during a separate one-on-one interview a student who had not taken Geography in secondary school, provides a different perspective when asked if they have been provided with water education. This student provides a contrasting response, demonstrating that the levels of water education within eThekwini are vastly different. This other student responded by stating the following:

> *I don't think I've actually received water education, but I think I've been taught about water at some point in my life. … For me, I think that what they taught us isn't water education … it's like saying AIDS is a disease that you get if you don't use a condom, but that's not actually educating someone about anything, you're just telling them how to not get [AIDS]. I feel as though we're taught not to waste water, but I feel as though that's not water education because that didn't teach me anything about water… You know what I mean? They were just giving us tips on how to not waste water, but it wasn't really education, because we didn't gain anything from it. Well, I didn't.* (Community Development and Anthropology, graduated secondary education in 2012, 2017).

In addition to these student responses, the majority of participants indicate that they believe they have received water education mostly in primary school and could not remember receiving any in secondary or tertiary education. Two participants believe that their water education is due to their own self-education and tertiary education, through their own interests and initiative to read-up on the subject. Another two participants did not believe that their water education truly comes from formal education, but rather through their own family members, particularly elders. One of the students said the following when explaining who has provided the most water education: "*I think my gran, because I know when the water bill is high that she's the one suffering."* (Industrial Psychology, graduated secondary education in 2012, 2017). Of all the interviews conducted, only one participant believed that they have been provided with water education throughout primary, secondary, and tertiary education and is well aware of the

issues surrounding water and the appropriate conservation efforts that should be made. This participant has the following to say about how they truly came to understand the importance of water conservation:

> "*I keep all the taps closed, make sure there's no leaks, I don't wash my car anymore. The general impacts of the droughts, seeing how it affected people made me change. In my community there's not much water and it's a struggle to get it, to go and fill buckets."* (Electrical Engineering, graduated secondary education in 2012, 2017).

This perspective resonates strongly with the input that UKZN academics provided during interviews. By seeing the impacts of water scarcity and the lack of availability, an understanding of water conservation seems to become more common. In understanding the student perspectives of their perceived level of received water education, academic staff members of Howard Campus also have some interesting experiences to share regarding the water education of eThekwini residents.

4.1.2 Staff Perspectives

The UKZN staff members that have been interviewed have experience teaching students about water, environmental and conservation issues, have participated in projects that engages locals regarding these matters, and/or have worked extensively on campaigns and with Municipality and government representatives on environment, water, sanitation, housing, and land issues. When asked what they believe is the understanding of water education within local communities, UKZN academics all had similar perspectives. There are two participants that believe in the extreme, implying that people do not value their surrounding environments and are not conscious of how their actions affect any surrounding water sources. One participant explained that many community members blame the municipality for the lack of water. Eight participants believe that people are aware of water conservation and the importance of water, while five of these participants explained that many residents directly rely on their surrounding environment and therefore understand how their actions affect the environment, and how these actions cycle back to affect them. One of these interviewees explained that,

> *When you work in informal settlements and you see how harsh the environment can be on people and then you see how they try to sustain it. … the understanding of the extent that the environment affects them. People's awareness of environmental risk I think has increased quite dramatically in the last while. More of what's becoming apparent to me is that people are understanding this relationship between environment and development.* (Geographer, specializes in social and environmental dynamics, and Senior Lecturer, 2017).

Five staff members believe that when evaluating local residents' level of water education, considering the class dynamics and physical challenges that many locals face is important. They expressed that these factors can affect a participant's level of environmental awareness, appreciation of natural resources, and the access to resources such as water and education. In particular, one interviewee explained that, "*... people perceive the problem differently and if we go down to the rural areas … water is very highly valued, because people actually have to walk to a river to collect in buckets, otherwise there is a municipal tap provided."* (Environmental Scientist, specializes in environmental geology and geochemistry, and Lecturer, 2017). Additionally, when discussing wealthier residents the following participant believed that, "*[t]he elite communities … live in better quality environments and are more likely to support campaigns to build environmental awareness, conservation issues, etc., so there's a strong class component to that awareness."* (Geographer, specializes in urban/rural sociology, and Professor, 2017). There are therefore mixed opinions of who is prioritizing the conservation of water and what factors outside of education are imposing on their ability to practice water conservation.

4.2 South African Agencies Implementing Water Education

Through researching the standard of education that is distributed throughout South Africa, with the use of the CAPS documents, it is evident that there are in fact high levels of water education recommended to all schools for teaching. This means that through formal education, the Department of Basic Education is providing resources to ensure that all teachers follow a curriculum that includes water education.

When implementing the Foundation Phase of education, CAPS recommends that teachers allocate certain amounts of time per week to teach about water, during the *Beginning Knowledge and Personal and Social Well-being* component of the Life Skills curriculum (Department of Basic Education, 2011a).

Figure 4.1 below is a visual representation of this time allocation, available through the Department of Basic Education's CAPS package,

Figure 4.1: Representation of Time Allocation Per Subject

GRADES R-2		TOTAL TIME ALLOCATION PER TERM	GRADE 3		TOTAL TIME ALLOCATION PER TERM
Beginning Knowledge and Personal and Social Well-being	2 hours per week	60 HOURS	Beginning Knowledge and Personal and Social Well-being	3 hours per week	70 HOURS
Creative Arts	2 hours per week		Creative Arts	2 hours per week	
Physical Education	2 hours per week		Physical Education	2 hours per week	

Source: *CAPS Life Skills English*, Department of Basic Education, (2011a:19).

Throughout these classes, topics related to water that are discussed include saving water, healthy environments, the uses of water at home and school, ways of saving water, storing clean water, why we need water and important sources of water, freshwater and saltwater examples, recycling and reusing water, and water pollution (Department of Basic Education, 2011a). In terms of understanding the basic concepts of water, such as the water cycle, the sources of water, the human importance, and the domestic uses, this phase of education seems to provide the necessary education and knowledge.

In the Intermediate Phase, Social Science, Natural Sciences and Technology, and Life Skills curriculums all have components relating to water and the implementation of this education. The Social Sciences curriculum presents a Geography component in which the different sources of water in and surrounding South Africa are outlined, how the uses of water have changed over time, such as through transportation, and the concepts that are taught in earlier years are furthered (Department of Basic Education, 2011b). The Natural Sciences and Technology curriculum also presents outlines of the concepts of water pollution, the mechanics of water, where natural sources of water are found, and the different processes to purify water. These concepts carry-on into the Senior Phase of education, with Social Sciences and Natural Sciences continuing to implement concepts that strengthen the knowledge that is provided in previous years.

When students reach the FET Phase is when they begin to have some choice in the modules that they choose to enroll into. Concepts of water and the implementation of water become less likely to be taught, should students choose not to enroll in courses such as Agricultural Sciences, Geography, Natural Sciences, and so forth. From the responses attained through student interviews, it is evident that many students seem to remember receiving water education mainly in primary school, and those who remember learning more about water in secondary school are those who had chosen to enroll in Geography classes and Natural Sciences.

In reviewing the CAPS curriculums, it is evident that the use of practical examples is consistently recommended to complement the standard resources being used during lectures (Department of Basic Education, 2011e). Additionally, DVDs, newspapers, magazines, TV nature programs, reference books, media reports, flow charts, posters, pictures, diagrams, drawings, access to ecosystems, website information from the Department of Water Affairs, and using field guides and keys are all suggested applications to carry-out the investigations, experiments, and demonstrations components (Department of Basic Education, 2011a). These resources and activities are recommended throughout all phases of education and imply an active role of the learner to cognitively relate to the teaching material being presented. Figure 4.2 is an example from the CAPS curriculum presenting these suggestions.

Figure 4.2: Representation of Recommended Resources for Grade 1 Class

LIFE SKILLS GRADES R-3

Term 4 Grade 1		
Beginning Knowledge and Personal and Social Well-being	**20 hours** (2 hours/ week)	**Recommended resources** In addition to the standard resources for Life Skills you will need: • Picture maps with stories • Pictures of homes • Examples of different building materials • Pictures of the moon

- **Do routine activities and free play activities indoors and outdoors as specified in Section 2.**
- **Keep daily weather chart updated.**
- **Revision, assessment and feedback should be done on an ongoing basis. (Time allocations allow this.)**
- **Religious days and other special days celebrated by the community should be discussed as they occur throughout the term. (Two hours per term are allocated for this)**

Topic: Homes - 4 hours

- Types of homes - include flats, houses, shacks, traditional homes
- Homes to suit different weather conditions
- What different homes are made of - include wood, mud, bricks, tin, stone, hardboard, plastic

Topic: Picture maps - 4 hours

- Finding places and things on a picture map
- Finding the way from one place to another (use words such as: along, over, under, up, down)
- Finding where on a picture map events in a story happened

Notes:A picture map is a drawing to show where things are located in a given area. Picture maps develop geographical skills of location, distance and space.

Topic: Water - 4 hours

- Uses of water - home and school
- Ways water is wasted
- Ways of saving water
- Safe and unsafe drinking water
- Storing clean water

(Source: *CAPS Life Skills English*, Department of Basic Education, 2011a:38).

4.2.1 Water Education Received by Students

During interviews, students were asked how they had received their water education and what sources were used to implement this education. Despite two students indicating that they believed that they had not received water education, almost all participants recalled having been provided with posters, books, textbooks, maps, images, musical, and audiovisual resources when being taught. When asked to elaborate, three students remembered taking part in activities to further understand the concept of the importance of water and water conservation. A student had to following to say when discussing

who they had received the most water education from: "*[d]efinitely at schools, but the lower levels of school. It was more constant, we had things to remind us, like singing songs, posters, and other reminder."* (Housing, graduated secondary education in 2012, 2017). Furthermore, all students remember having more active and participatory approaches to learning about water during their primary education phase, with only one remembering these approaches during secondary school. Many students express the use of the participatory and asset-based approach during their tertiary experience. The quote below demonstrates one of the student's perspective on the teaching style differences they noticed throughout their tertiary education,

> *In class, as it is, we are more encouraged to engage more than the lecturer is encouraged to just speak and give us information. This is mainly in masters. Before, there was not so much of this. In primary school and high school a bit, but mainly in masters.* (Geography and Environmental Management major, graduated secondary education in 2011, 2017).

4.2.2 Informal Water Education as Explained by Academic Staff

As interviews with academic staff members progressed, it became clear that most academics were also heavily involved in projects outside of the formal education system, especially to teach water and environmental education. One lecturer gave an example of how university members began working with a specific informal settlement, which will remain unnamed to ensure anonymity. In this example, the interviewee is very positive about the work they have been doing with community members, and specified that it is very much a social learning experience, using asset-based and participatory approaches with experiential learning methods.

They said the following about their time working within the settlement,

> *People are quite engaged, I can see that they are reacting to it and really trying to think about it. In [the settlement], it started out by asking, 'what is your relationship with the river?'. We didn't start off by saying, 'you have to conserve the river or clean your river', and the minute you start looking at those relationships, those things are going to emerge.* (Geographer, specializes in social and environmental relationships, Senior Lecturer, 2017).

Another interviewee spoke of a separate project that they were involved with, explaining that,

> *it was a project on climate change generally and water issues in the City of Durban and so what we were trying to do was get the communities to work with us to develop a program or a way of understanding climate change related problems in the Municipality, so that they would be not just participants in the study, but knowledge creators. So to try and see things from a new perspective, to create new knowledge about the management of environmental issues along the Durban coast.* (Specializes in land reform, small-scale agriculture, and rural development, Senior Lecturer, 2017).

From these and five other responses, it is evident that university academics have been engaging with municipality representatives, local residents, Umgeni Water, and NGOs, such as the South African Education and Environment Program, the Environmental Education Association of Southern Africa (EEASA), and the Wildlife and Environment Society of South Africa (WESSA), creating a dialogue and learning environment for all involved. Through these works, it is clear that there is a component to water education that is being taught informally to engage with locals outside of the traditional education setting. These projects, workshops, and campaigns are working toward increasing the number of knowledge providers that are teaching water conservation and including locals in this discussion, allowing them to understand how they can enhance their relationship with their surrounding environments.

4.3 Effect of Current Water Education Methods on Consumption

In attempting to understand how the current education methods have affected the water habits of eThekwini citizens, staff perspectives provide significant insight as to the different dynamics and how these relate to education. For the purpose of this study, the concept of 'consumption' is not in relation to the actual amount that residents use, but rather the mindset of consumption and how individuals grasp and monitor their consumption of water resources.

Throughout my interviews with academic staff members, it is very clear that they have all gained different perspectives of Durban locals, the understandings of water education, and their relationship with their environments. Despite this, many had very similar suggestions as to why eThekwini residents are not consistently sustaining their water resources. These responses demonstrate that there are components to the lack of water conservation awareness and education that are beyond the scope of the CAPS curriculum. The following section is be divided by the seven different components that represent what academics interviewed believe are imposing on locals' access to water consciousness. Intertwined within these components is the context of race and what the history of South Africa has created within and amongst the population groups in the nation, and how these are prominent within these components.

4.3.1 Displacement & Housing

In understanding the context in which academics were discussing the complex issues that surround water and water education, they were asked to provide some examples of why they believed locals react to the environment the way they do. It is important to understand that Durban, as mentioned in Chapter One, is a highly diverse city. Through this diversity, there is also a longstanding issue of land requisition and housing, which include the contexts of in-situ upgrading, relocation, and the Reconstruction and Development Programme (RDP). Due to these components of the housing issue experienced nationally, Durban also sees the impacts of the displacement and the challenges that the government and its people have been faced with in an attempt to reverse the effects that have followed the forced removals. These stories relayed by the academics and their perspectives as to how this dynamic has affected water education and environmental consciousness are therefore expressed.

When discussing the relationship that many residents have with their surrounding environment, the Professor and Geographer who specializes in urban/rural sociology, purposefully explained that,

> *[i]f you look at traditional African societies, there's a respect for what we call 'mother earth', and then a number of traditional practices in terms of how the first harvest is celebrated and so on. This happens in many parts of the world, in Africa and South Africa. However, when people have been displaced from the traditional communities, when people have been dumped into poor shack settlements then the focus [on] conservation can hardly be a priority under those circumstances.* (2017).

This dynamic is important to consider and are be further discussed, but one must consider the low level of responsibility that individuals are likely to have to an environment that they do not have a sense of belonging to and ultimately do not consider their 'home'. To add to the context of water consciousness, many locals who have been displaced are "*living right up against the environment. … It's not that the urban poor are not conscious of the environment, it's that their pursuit of livelihood supersedes the management of the environment. … But … people need a place to stay, so it's a trade-off."* (Geographer, specializes in social and environmental relationships, Senior Lecturer, 2017). In other words, people are faced with environmental risk on a daily basis because these settlements of displaced people are mainly located in undeveloped areas. This means that on a daily basis, and in particular when weather patterns become extreme, locals are hyper-aware of the surrounding environment and their direct impact on it.

However, their struggle to provide themselves with basic needs, such as food, clothing, and shelter, also imposes on their ability to prioritize the environment over their survival. In addition to this component, a shift in consumption occurs when individuals transition away from informal settlements. One of the interviewees, who was speaking of informal settlements where water and other resources are not readily available, stated that "*you'll find that it is in a rural community, where water is scarce, [is where] they will value [water] highly, but the same [individual] comes to the City [where] water is available on tap, then … the mindset changes completely from 'you have to conserve' to 'you do not have to even think about it!'"* (Environmental Scientist, specializes in environmental geology and geochemistry, Lecturer, 2017). As explained by this lecturer, there are many people that are not prioritizing water conservation because they no longer feel the pressure to save water or to use it wisely.

4.3.2 Class & Poverty

In an effort to fully understand the complexities of South African citizens' relationships with their surrounding environment, we must also address the effects that the class and poverty components have. As previously mentioned, South Africa is a highly diverse nation and the eThekwini Municipality is no exception. Through this diversity, we see different attitudes toward the environment that also range when looking at the financial classes that exist within the Municipality. The following interviewee had an intuitive perspective as to why this stigma exists, in that those who are not as financially secure have less of a responsibility to their environment. This interviewee said that, *"a lot of people argue that conservation is some Western imposition or idea"* (Geographer, specializes in urban/rural sociology, Professor, 2017). Similarly, a separate interviewee explained that in rural communities, there is an idea that because they are so physically to the water, they are therefore be more likely to take care of it. Clearly bothered by this issue, this interviewee explained that in their opinion,

> *People do not take care of their rivers now-a-days, they pollute them like hell, and people no longer respect their rivers … and those who are trying to do justice to river waters are the people that somehow are looking like they are looking for opportunities from the municipalities … Rural people, you expect them to preserve water or collect water from the rain like we used to do when I was young, but nowadays people don't do that because the rivers are not clean anymore, you can't use that water for washing.* (Community Activist, specializes in climate change and water adaptation, Researcher, 2017).

There are two factors to gain from these interviews. The first is that the poor are commonly either thought of as too poor to be able to take care of their environment due to their struggle to survive, or they are considered as inherently being the conservationists of society. The latter of these two is discerning because as previously stated, the concept of conservation is commonly considered to be a Western concept that is being imposed onto other countries, despite it being quite evident that people have been living off of the land for years. For people to live off the land, they had to have been sustaining the land. This is where the poverty component is seen. Here is the perspective of one academic who explained their thoughts on how class and wealth play a role on someone's ability to conserve. They believe that, "*a privileged person may have more time to think about the environment and do things for the environment, whereas someone else is thinking what they're going to eat that night and how they're going to get to school. It's not that they don't care, it's more about survival."* (Urban Geographer, specializes in socioecological systems, Researcher, 2017). On the other hand, one of the other academics discussed the position that Western culture has been imposing the concept of natural resource conservation for the purpose of continuing to exploit the resources of less developed countries for their own gain, leaving little to no benefits to those countries that are actually working to conservation. This interviewee said that,

> *If we talk about conservation, the question is then: conservation for who? Because if we assume that the concept is neutral, it is not. If people in developing countries conserve, the people from the Western world will take it. So if you look at it from a different perspective, they made a plan for themselves, not for developing nations. They get raw materials from those people who conserve them to minister to the needs of the Western world.* (Environmental Scientist, specializes in human geography and plant species, Lecturer, 2017).

As a result of these interviews, we must acknowledge that the concept of conservation has a component of class, wealth, and eliteness. If we consider how many farming and traditional communities would have lived in the past, they were not sustaining their resources with the purpose of conserving but rather with the purpose of being one with nature and sustaining themselves (Walker, 1999). Furthermore, when considering the intense poverty that can be found in the peripheries of cities throughout the nation, we see countless people fighting for basic services because the lands that they have been relocated or displaced to inhibit a lot of risks.

4.3.3 Not Grasping the Severity of the Water Crisis

This component of water consciousness, which is also applicable to environmental consciousness as a whole, is important because it resonated throughout my interviews with both local students and academics. Both groups recognized that many residents may know about conservation of the environment and water saving practices to reduce scarcity, but many of them are not aware of the severity of these issues and the impacts that their lives have on their surrounding resources. One student who studies Geography and Environmental Management, explained their observation of the water conservation matter and their own dilemma by saying the following:

> *I still feel that it's there in abundance even though I know that we're not in a good position right now. I believe when people say that we need to conserve water and I see the need, but I also need the water. I still feel like because I don't see it everyday firsthand, then it's hard.* (graduated secondary education in 2011, 2017).

A different student gave their thoughts about the water situation in Durban by saying,

> *What is the water situation in Durban?! I recently heard somewhere that we have the cleanest water so … I don't think there's a problem, because we have clean water. I've never experienced a problem, except for one time we actually ran out of water, but I've never actually thought about why sometimes we run out. Is it because we're running out of water?* (Community Development and Anthropology, graduated secondary education in 2012, 2017).

Surely, someone who has lived in Durban their entire lives, been educated with the standards presented in the CAPS documents, and has continued to study in tertiary education would have at some point learned about water scarcity and the importance of saving water. I can say firsthand that this student is very competent and self-aware, but it seems that the system, both formal and informal, has failed to relay the need for water conservation and why it is so important.

Academics, with experience of working with local residents and other agencies on conservation projects and teaching students about these national problems, have similar perspectives to the first student's opinion presented in this section. Seemingly quite bothered when explaining the lack of education that many people appear to have with regards to water, this academic had this to say:

> *I think one of the things that strikes me, especially with water, is always how little people actually know about water. … So even in teaching … I'm amazed at how little people have thought about, 'where does your water go, where does your wastewater go, what happens to it?' and that's across the board. People don't think about it, it's all been taken away from them and people don't manage it and they don't think about it.* (Geographer, specializes in social and environment relationships, Senior Lecturer, 2017).

This component can also be thought of as a result of the differences between the livelihoods of those living in urban vs. rural areas. One of the academics explained that,

> *if you look at a significant percentage of the students in our classes, they live in urban areas. To them, if you talk about water, it means opening a tap and then you get water. So I think it's one of the reasons why when people protest on TV and say they don't have water, to an urban person they don't understand because to them you open the tap and you get water.* (Environmental Scientist, specializes in human geography and plant species, Lecturer, 2017)

As a result, there is no doubt that a portion of citizens within eThekwini are either not aware or understanding the severity of the water shortages that countless citizens have been facing.

4.3.4 Education

When discussing with academics about what they believe the root of these complexities is and how to actually increase water awareness and conservation efforts, almost all of them explained that education and access to that education is a key problem. Below are some of the responses of how to enhance people's awareness of water conservation:

> *The root of it I think is education, I'm looking at formal and informal education. Certainly in formal education, I don't think much serious conservation work comes into the curriculum in schools. And once again, it's not seen as a priority, it's seen as some elite hobby or something. So that would be critical for the reconfiguration of the syllabi.* (Geographer, specializes in urban/rural sociology, Professor, 2017).

After reflecting on this participant's response and understanding their perspective on improving water education, it is important to remember that the ways in which people receive education can play a large role in their process of knowledge building especially with cognitive development. In the following section we see another suggestion of how education can be improved to allow for eThekwini residents to become more knowledgeable about water conservation. What is interesting is that this academic had a similar view, building onto the previous statement. They expressed that, "*I think first academically it can be improved by adding another module, just for the first year of high school. They can have projects, workshops, conferences, one-on-one interactions where they learn about these things."* (Mining and Quality Control Engineer, Researcher, 2017).

In agreement with the Engineer's response, the following Scientist explained that they also believed that the Municipality's residents' level of water education could be improved, but the format in which students are given this education had to change. Both of these participants explained that it is the

modules themselves, and the ways in which they are being taught, that are limiting water education, because the classes that teach specifically on the environment are not mandatory. This Environmental Scientists had the following to say on the matter,

> *… it can be improved. … Unfortunately we are constrained by the curriculum. … The school curriculum in the country, students have choices, so as electives students may not select classes like geography in which they would learn that. Maybe they should make a class where all students have to take learn about it.* (Environmental Scientist, specializes in environmental geology and geochemistry, Lecturer, 2017).

In addition to the curriculum itself, two participants criticized the knowledge itself that is being presented to students and the people who are chosen to teach students. With the concept of participatory development being discussed, these two participants suggested asking local community members to assist teaching water concepts, the environment, and the importance of conservation. The following represents one of these academics and their suggestions:

> *First of all, you actually recruit people who are knowledgeable. Not in terms of having a degree, but … people that don't even have matric. Those are the people that are knowledgeable … they have occupied those areas, they actually know all the events that happened through the years, so those people are in a better position of imparting knowledge, … [and] add another dynamic and perspective.. Do you know how stressed teachers are? If it not part of a curriculum they teach, do you think they will take initiative? No, not unless it is in their curriculum.* (Environmental Scientist, specializes in human geography and plant species, Lecturer, 2017).

The second of these two academics expressed the importance of integrating different members of community, not just one teacher and moderator. Instead, they suggested having the Municipality engage with students and residents themselves. They had this to say:

> *... the awareness is also a responsibility of the Municipality, through meetings with the community, through schools and education. There should be subjects involving water issues, especially in primary schools when kids will be able to care. In high schools, the learners are just looking at the pass rates and what they are going to study.* (Community Activist, specializes in climate change and water adaptation, Researcher, 2017).

Lastly, the following academic discussed how different learning material could be provided to students, as a form to engage students and help them understand the content that is being taught, rather than simply memorizing. Here we see an important critique of the education system, where true learning is lacking and is being replaced by point systems and test scores.

This academic explained that:

> *... even good fact sheets about how things work that people could look at and learn from. The problem is the school system today. Children are not learning to learn things, they're learning to get marks and it's completely messed up the education system. It's like a big sausage factory. It's terrible. ... I think the whole education system is not helping 'real learning' where children are understanding why they're learning this stuff, they're trying to get through a system that gives them points for something that gets them somewhere else.* (Geographer, specializes in social and environmental relationships, Senior Lecturer, 2017).

In retrieving this data, it is no surprise that even within the context of education, there are complex issues that must also be addressed and improved.

4.4 Development Approaches

To complete this study's data collection, I must present how the three development approaches, cognitive, asset-based, and participatory, are understood by both UKZN students and staff and the perceived effect on water education. When beginning this study, I personally thought of the participatory development approach as the most effective and inclusive approach and therefore believed that it would be the best approach to enhance current water education in eThekwini. However, through these interviews and discussions, I have become aware of the effect that combining these approach could have on not just water education, but education as a whole. I must be very clear in stating that these approaches, for the purpose of education, may still be challenged by the dynamics that have been presented, such as class and housing challenges. The approaches can nonetheless assist in enhancing water education within eThekwini to create a level of awareness that shifts a resident's understanding of water, its importance, and the shortages that the nation has continued to face.

As one student explained:

> *... they could be combined. The asset-based approach, you could take the aspect where you use already existing assets and capitalizing on those so that you already have an existing starting point that also minimizing the need for example resources. Participatory approach, the advantage is definitely integration, more people are involved, which means information is relayed better. ... and I think this method may take longer, but I think it definitely has more long-term effects, the cognitive approach. Simply because what you learn and absorb, you don't lose. You know? Those practices, you don't lose because it shapes your way of thinking and understanding and using information. And also with the cognitive approach that they can relay the information to your family members, your children, so I think it's got more long-term effects."* (Geography and Environmental Management, graduated secondary education in 2011, 2017).

The majority of students did gravitate toward the cognitive and participatory approaches for long-term effects, recognizing that the cognitive approach would take many years to develop. In terms of asset-based, all students seemed to believe that it is important for them to be able to identify local sources of water that they are directly impacted by in order to fully grasp how crucial these sources are to them and how interrelated their existence is with water.

Evidently, the solutions that many of the academics raised are to do with education and the ways in which this education is being relayed. The concepts of engaging students, having them understand and connect with the information, and using relevant examples are all components of the three approaches.

4.5 Sources of Water Education Distributed by eThekwini

As previously stated, it is quite clear that through formal education, schools are provided with standard guidelines as to what subject matter and information relating to water education is meant to be provided to students. However, as the interviews have shown, students have varying levels of water education. When asked if they believed that they had received water education, answers are inconsistent, with strong refusal of having received this education to highly water conscious students attributing their knowledge to formal education. Although answers are not conclusive, a few students did give examples of how there are other sources of water education that they have come across, made available by eThekwini, that are not presented to them through traditional forms of education. This student explained that:

> *I've been seeing a lot of posters of our mayor, Zandile, and they're literally standing in a billboard and behind is a picture of a dried up river and the tagline is, "we are in drought", and then I've been seeing these videos just posted where they've been speaking about water scarcity in Durban. So I think … it would definitely affect the way we approach water. Its disadvantage is for the illiterate, I guess, it would be a bit hard for them to understand.* (Geography and Environmental Management, graduated secondary education in 2011, 2017).

There are two key factors to note from this student's response. The first is the detail in which the student speaks when describing these posters, showing that they clearly took notice and were impacted. The second is their statement at the end which speaks to another challenge facing water education and its

accessibility. Language and levels of education need to be taken into consideration when attempting to implement better strategies for water education.

In terms of active participation, three students believe that the knowledge they gained related to water is all through their own active reading and self-education. When asked if they found that resources are readily easily available to them, they all said that they are. One student explained that it is easy to find information on water, it is just the initiative to search that a lot of their colleagues are missing.

4.6 Conclusion

The purpose of this study is to understand what the current level of water education is within the eThekwini Municipality, how it is being implemented, and how it could be improved with the use of the three development approaches, cognitive, asset-based, and participatory. With the intention of getting these answers, I believed that speaking to students who had gone through primary and secondary education would give me some insight into how water education is realistically received in a formal setting, with CAPS as guidance. When speaking to students directly about their education and how it related to the importance and scarcity of water, it is obvious that many students did know that water is important and that it is good to conserve water, but few students could actually explain why.

When discussing the concept of using cognitive, asset-based, and participatory development in order to enhance water education in the classroom, many students believed that these approaches would be helpful. Speaking with UKZN staff presented a number of different dynamics that they believe are also imposing on many residents' ability to conserve water. However, all staff speculate that the first aspect that needs to be changed is the education system. A few discuss the concepts that relate to the participatory approach, such as knowledge integration, experiential learning, and active participation, while others discussed concepts of cognitive development and asset-based, such as starting from an early age and continuing these education platforms throughout primary and secondary schools, using local examples that students can see are being affected, and focusing on their waters and understanding how they can better impact them. This chapter presents the relevant data that is collected through

literature review and one-on-one interviews. The collected data can now be further understand and analysed in the following chapter.

Chapter Five: Conclusion and Recommendations

5.0 Introduction

This study has now presented the qualitative data collected to gain insight into the opinions of UKZN students and academics about water education and the ways in which it is taught. Additionally, we have discovered other factors that affect a resident's ability to conserve water and the stigma that comes with the concept of water conservation. To identify how these findings and others can be used within the education system, we must first understand the key findings, discuss their implications, and how they can be used to apply to practice and policy. I am then able to present my realization of objectives and my final recommendations for this study.

5.1 Limitations of Research

This study faced a few limitations during the data collection process. One of the main limitations is the number and distribution of participants, their expertise, and age range. Since the research did not involve a numerous participants, neither student nor staff, then we must acknowledge that the results, opinions, and perspectives that were provided during interviews are not representative of the whole student body, nor all individuals that have been enrolled in primary and secondary education in eThekwini. The student participants that took part in interviews are currently enrolled, in their 20s, and have an elevated understanding of the education system. Similarly, the UKZN staff members that were interviewed represent themselves as giving their own perspectives and opinions, not to be interpreted as descriptive of the whole UKZN staff community. They all had an understanding of water issues within Durban, the contexts of water, and had experience with teaching students or locals, working with local residents and stakeholder representatives, and/or partaking in research projects that involved cognitive, asset-based, or participatory approaches. It is therefore clear that these members also had a pre-existing understanding of water education within eThekwini and how the three approaches have and have not assisted in engaging locals.

The second limitation arose when interviewing students. It is evident that because students knew beforehand that the subject matter of this study is to do with water education, there could be a premeditated idea of water education and how they relate to this subject. In essence, because students are given the subject matter before interviews, they might be able to rehearse their perspectives and opinions rather than responding with unfiltered, unrehearsed, and initial reactions to the questions and discussion points.

The final limitation that must be acknowledged is in the lack of diversity amongst the participants that are interviewed. The students interviewed have been raised with a similar awareness of culture and tradition, in the sense that they understand how their elderly family members perceive the environment. The majority of students speak about how certain family members still 'live off the land', live in rural areas or homesteads, and respect their environment. With this, it is important to note that the lack of diversity limits the perspectives received, in that those interviewed have gained an understanding of what the environment means through informal education by family. However, despite these limitations it is clear that all participants were honest and thoughtful with their responses, taking time to accurately articulate what they meant and respond to the questions being asked. The purpose of this study is not to attain a conclusive decision on whether or not the current methods of water education are effective, but rather to get some firsthand perspectives of how they have been received by students and how they could be improved based on their experiences. In essence, the responses attained serve to identify how water education has and has not been practiced, the impacts that water education has had on eThekwini Municipality, and how these can be rectified with the use of cognitive, asset-based, and participatory development approaches.

5.2 Discussion

From the assessing the data collected through this study, there are key findings that will now be summarized, discussed, and clarified in terms of their implications on water education through

implementation. In addition to the findings the objectives of this study have been combined and refined in order to outline the following discussion questions:

- Do local residents have strong water education and an understanding of why it is important to learn about water?
- Are South African agencies implementing water education? If so, how?
- What effects do current water education methods have on water consumption?
- What sources of water education does the eThekwini Municipality distribute to local residents?
- Are the cognitive, asset-based, and/or participatory development approaches being used to practice water education?

In order to answer these questions, the most important and relevant findings from both the literature review and interviews are summarized and presented. These support the findings and present my interpretation of what the data represents.

5.2.1 Do local residents have strong water education and an understanding of why it is important to learn about water?

When assessing the interviews and the data collected, it is evident that few students have a strong level of water education or even fully understand why water is so important. This is not to say that they are not aware of basic information, such as why water is important for us in our daily lives and simple ways to save water, but the depth of this knowledge is not far. In the literature review, the concepts of understanding the water cycle, the different sources of water, the human need for water, and the domestic and larger consumer uses of water are discussed. In the interviews, only two students were able to explain to me where water comes from, how dams and other water systems impact our water sources, and how interrelated our existence and sustenance is with water. When these questions are posed to the other students, one student explained that they understand the basics about water, but they do not feel as though the education that they were given is sufficient in order to successfully know about all aspects of water and water conservation. This is quite impactful, because it led me to conclude that although there is a standard for the content of education that is meant to be taught, this knowledge is either not being presented or it is not being presented in a way that is meaningful to the students interviewed. In saying this, it is even more important to note that the two students that do have a strong sense of water education, as per the concepts discussed in the literature review, are students that had admitted to having

an interest in the environment and had majored in environment related programs. Therefore, the students that did have a strong sense of water education had received much of this in tertiary education.

5.2.2 Are South African agencies implementing water education? If so, how?

In understanding the previous finding, it is clear that there are in fact agencies implementing water education. The main resource comes from the Government of South Africa's Curriculum Assessment Policy Statements, which provide guidelines and standards for all schools and teachers to follow to ensure that all students are receiving the required information through to education system. Evidently, students do have some sense of water education, even if it is basic, therefore concluding that the education is being presented to students.

Through reviewing the staff interviews that were carried out, it is evident that a large majority of UKZN staff, both lecturers and researchers, are involved in various projects involving water and the environment. In an effort to maintain their anonymity their projects are not be named, but the participants and other leaders of these projects are another indication that other agencies, other than teachers in formal education, are in fact implementing water education. Of the mentioned project participants are representatives from NGOs, the Department of Water and Sanitation, eThekwini Municipality, Umgeni Water, the South African Education and Environment Program, the Environmental Education Association of Southern Africa (EEASA), and the Wildlife and Environment Society of South Africa (WESSA). With the help of these outside project participants, other academics, and local community members, it is clear that people are getting involved in initiatives to conserve water, learn about local water assets, and enhancing their water education. In a few of the examples that were provided, it is clear the all three approaches are being used in these projects. The cognitive development approach is mainly used with young children, to help them relate with their surrounding environment. In combination with the cognitive approach, many used the asset-based approach by presenting local water assets and demonstrating how important it is to clean and preserve these sources. The three approaches were also used in these examples in combination when relating with young adults, adults, and elderly individuals and groups by allowing them to participate in discussions, engage in

knowledge integration, share experiences of how they related to their environments from an early age, and using local examples to allow others to relate to their experiences.

5.2.3 What effects do current water education methods have on water consumption?

In understanding the current water education standards through the CAPS documents and data collected during interviews, it is obvious that there is water education being taught to eThekwini residents both through formal and informal education settings. However, although the methods used to engage in water education in the informal education setting is provided by interviewed staff members, the ways in which water is taught through the formal education system is not provided. It is essentially quite difficult to understand the tactics and practices used by teachers within the classroom unless those classrooms across the Municipality are assessed. Nevertheless, from interviews with students it is clear that the cognitive, asset-based, and participatory approaches were used in some of these students' experienced during the formal education setting. The cognitive and asset-based approaches are mainly used in primary years, particularly when teaching students about water, where water comes from, how they can relate to their environment, and which water is not safe to drink or use. In terms of participatory, many students remembered taking part in projects to clean water, identify safe drinking water, learning about the water cycle through images and videos, and taking part in programs to clean local water sources.

Although it is evident that the education methods that were practiced during primary and secondary school seem to have been retained in the students' memories, the impacts of these methods may not have been as long lasting as anticipated by those implementing these education methods. Many students, when asked if they believed that they practiced water conscious methods explained that they only practiced water conservation when they remembered or when they read or see on the news that there is a drought. Essentially, the concept of saving water did not become one of day-to-day importance and practice, but rather an act that is carried out when water levels are stressed.

Alternatively, when speaking with UKZN staff members about their experience working with locals and their attitudes toward water many expressed a distinction between the ways in which elderly

and younger individually interact with their environment. The one example that stands out is the explanation that one of the interviewees gave when discussing the different dynamics in the communities. This participant explains that when initiating the project there is some tension between the young and the old. However, when the project continued and the members began to learn from one another and work with each other, these tensions quickly disappeared. All participating members seemed to understand that they are coming together for a common goal.

There are therefore two main aspects to this question. The first is that the current water education seems to not be connecting with students in a way that can result in long-term impacts. Students are aware of how to save water when they are placed in an environment where it is deemed necessary to conserve water, but unless water conservation is stressed then they are less likely to save. This means that water consumption among students is only reduced when they are reminded to do so or when agencies, such as eThekwini Municipality or news broadcasters, are promoting the need and importance of water conservation. Secondly, it appears that from interviews with staff the same can be said for local residents that are initiating water education through informal settings such as research projects. However, when engaging in these efforts it is clear that participants are again becoming aware of the need to conserve water. Furthermore, a few staff members believed that it is through the projects and the informal education provided that local residents begin to truly understand how their actions could impact the environment, which in the end also affect them. It is through these forms of education that individuals begin to comprehend how cyclical and integrated their existence is with their surrounding environment. In this sense, participants that have complete primary and secondary are only truly relating to their environment as a result of the informal education sector, through actively participating to cleaning their rivers and parks.

In terms of understanding how the current education system affects water consumption, it is clear that active participation and engagement with water conservation projects have presented more long-term results and have instilled a need and desire to conserve water more than the formal education system. This is not to say that the formal education system has not been successful in teach students how

to conserve water, but rather that the students have not been left with a sense of stewardship toward their water sources nor an inherent desire to conserve water.

5.2.4 What sources of water education does the eThekwini Municipality distribute to local residents?

During interviews with both students and staff, students expressed having received a number of posters, videos, and other visual aids, as well as participating in more involved water education activities, such as singing, dancing, and drawings. With the projects that staff members were involved with and/or are currently participating in, they discussed using similar visual aids, maps, and brochures. However, in larger projects it seems that the best sources of water education are actually people and experts themselves. Many municipality, university, and local community members were asked to provide insight and information when participating in environmental and/or water conservation efforts. It is clear that when the Municipality facilitated these programs, the distribution of information and integration of knowledge is more effective than the guides given to teachers for the classroom setting.

5.2.5 Are the cognitive, asset-based, and/or participatory development approaches being used to practice water education?

By understanding cognitive development, we can begin to identify how an individual's mindset and their conceptualization of their surrounding environment has been formed. In understanding how cognitive development works, the different phases which an individual may transition through, and the rationality of an individual can be an indication of how their formative cognition was developed, I can determine how cognitive development has impacted the relationship of individuals interviewed and discussed with water. In doing so, discussions with the majority of students that were interviewed showed that there are aspects of their relationship with water and their memories interacting with family, friends, and teachers that presented strong signs of cognitive development. This development is mainly carried out in the pre-operational and concrete operational phases, from 2-11 years of age. This conclusion is drawn because students mainly spoke about being a little child, remembering cleaning water and parks and being taught about saving water at an early age. Despite there being three students that discussed being taught by teachers in a happy and positive environment, the main similarity that

students speak about is being taught by their parents or grandparents. Many students seem to have cognitively developed a sense of care for the environment as they remember the environment fondly and therefore relate it to their childhood and the happiness of those memories. However, these memories seem to mainly invoke emotion and feeling, rather than an ingrained understanding of water itself. I believe that this is mainly because this level cognitive development in understanding water and the importance of saving it did not continue past the concrete operational phase. This means that many did not continue to save water in their daily lives, but rather at random events where it is being promoted or when interacting with those influential relatives. With respect to the formal education system, many students distinctly remember learning about water mainly in primary school, the lower grades, which is also indicative of the association with water education as a practice for younger children. Indeed, staff academics expressed the relationship within many cultures to connect with their environment. They explained the impact that the elderly have when they protect their environment; the teachings and lessons that they pass down to their family members. As some staff members said, this tradition is slowly disappearing, with more people moving away from rural into urban areas and living away from the natural ecological environment. As this tradition disappears, so do the teachings to young and adult family members and the tradition of caring for their environment. In this sense, that is also a component of how the cognitive growth of individuals is developing without the association to their environment or water resources.

The asset-based and participatory development approaches are prominent techniques used in teaching water education. When speaking to students, they described activities that involved identify local rivers, lakes, and understanding their oceans. In addition, these and other activities, such as singing, dancing, and presentations, involved their active participation. It is clear that these memories have positive and constructive emotions attached to them. The activities and identification tools have made a large impact on these students, allowing them to remember them many years after their graduation.

Staff members have a similar perspective when using the asset-based approach, but it is clear that the assets identified throughout the project are directly affecting the local community. In addition, these assets are seen as either environmental risk that need to be managed or natural capital that is being used and needs to be continuously taken care of to ensure that humans and nature are benefitting from one another in an equal interdependent relationship. The participatory approach is also used in a slightly different manner in these projects, as it engages multiple bodies and representatives within one working environment, all of whom are working toward the same goal. In these dynamics, lecturers, academics, municipality representatives, and local community members are engaging and sharing knowledge in a way that presents their expertise as equally valuable. There are some dynamics that were a challenge, but overall there is a large attempt to create an inclusive, inviting, and productive work environment.

5.2.6 Summary of Findings

List of Questions	Finding
Do local residents have strong water education and an understanding of why it is important to learn about water?	Few had a strong understanding, but all had basic water education.
Are South African agencies implementing water education? If so, how?	Yes, through CAPS packages, projects, and other initiatives.
What effects do current water education methods have on water consumption?	Through formal education, current methods are not effectively connecting with students leading to long-term results, therefore water consumption is not decreasing unless episodes of water conservation occur. Through informal education, all three methods are seeing success and water conservation and consumption are negatively correlated.
What sources of water education does the eThekwini Municipality distribute to local residents?	Posters, videos, visual aids, and brochures. Teachers are also encouraged to sing, dance, draw, and participate with learners.
Are the cognitive, asset-based, and/or participatory development approaches being used to practice water education?	Current education methods see the cognitive and participatory approaches used mainly in the younger years of formal education and asset-based throughout primary and secondary. With informal education, all three approaches seemed to be used.

5.2.7 Analysis

In understanding how the findings of this study can impact the perception of water education amongst eThekwini residents and what can be done to enhance it, I must also assess the similarities and

differences between my findings and those found by other scholars. In my study, it is concluded that all students do have a basic understanding of water, how to save water, and how to clean water and identify safe drinking water. Similarly to my finding, Anderson *et al*. find that those who reside in more rural areas are more understanding of their impact on their water sources and perceive water to be a communal responsibility (2007). However, Anderson *et al*. state that this connection with the environment is not related to education, but that education can be used to motive people to save and protect their water sources, as it "is positively related to taking action to treat water" (2007:133).

In terms of the effects that the current education standards have on water consumption, Duse *et al*. recognize that further education needs to be implemented throughout South Africa to ensure that better water management practices are applied amongst all citizens (2003). In their study, the scholars argue that all members of communities need to be provided with better education with regard to water and their management of water sources, despite their age, gender, or population groups (Duse *et al*., 2003). However, a study conducted by Sherwill *et al*. present similar results when investigating a community in South Africa, Sabie in Mpumalanga, and their relationship and dependency on their natural resources (2007). Sherwill *et al*. determine that despite being in a drought and how dependent residents were on their water catchments, they did not show much concern toward the depletion of their water sources and instead believed that their resource would not change much (2007). However, when speaking to those more reliant on the Sand River, it is clear that stakeholders and residents of the region had numerous conflicts on how to best management the river, with many disagreeing on the importance of domestic uses versus conservation for future users (Sherwill *et al*., 2007). Evidently, it is not clear whether residents who are more dependent on the Sand River had other safe water sources that they could rely on or if they were in fact conscious of their consumption. In terms of understanding their impacts on water levels and to be water conscious, results seem to be inconsistent and diverse which speaks to the different dynamics that were discussed when assessing one's ability to conserve water. In the case of Duse *et al*. and Sherwill *et al*., the contexts of race, class, and concepts of poverty are discussed and evidently influence an individual's ability and priority to conserve water (2003 and 2007).

Additionally, Hoffman *et al*. discuss the dissatisfaction that has been arising due to the education system's lack of consistency in the approaches used by educators to teach, and note the demand for approaches and materials to be used within the formal education setting (2007). These results are therefore conclusive with the results attained in this study in understanding the dynamics beyond education that affect an individual's consumption of water.

When evaluating the resources distributed to eThekwini residents to provide education about water, the data received from interviews with students is conclusive with that found in the CAPS packages. CAPS identifies resources such as posters, signs, books, textbooks, videos, and so on as effective tools to educate students (Department of Basic Education, 2011a).

To determine whether cognitive, asset-based, and/or participatory development approaches are being used in the education system to teach about water, the case study by Hoffman *et al*., two of whom are eThekwini Water and Sanitation staff, is referenced (2007). In this study it is clear that emphasis is being placed on the resource-based, commonly referred to as the asset-based approach, and the participatory approach (Hoffman *et al*., 2007). This study also asserts that these approaches have been producing successful results, therefore indicating that they have in fact been used to teach about water within the Municipality. This study is done a decade ago and teaching practices have likely expanded since this time. However, the case study itself may not be representative of the education received by all residents of eThekwini. In understanding how these approaches fair in the field, Bruce Missingham demonstrates how the asset-based, participatory, and cognitive approaches have been effective in teaching water education in the higher education settings (2013). Although this study is piloted in Australia, the result of applying these approaches to higher levels of education is in accordance with the findings of this study, since I have found that these approaches are more prominently used in the lower grades of education. It is therefore evident that if these approaches are to be carried out into the higher grades of education, such as secondary and tertiary schooling, then water education would be enhanced. This finding is conclusive with that found in Missingham's study (2013).

5.3 Implication of the Study

In this study, it is discovered that many students seem to have a basic understanding of the importance of water and water conservation methods. However, it is clear that when speaking with staff interviewees, the project participants that are involved with these interviewees seem to have a stronger bond and sense of responsibility for the environment and their surrounding resources after taking part in more inclusive and participatory initiatives. Additionally, through the integration of knowledge and experience, many adults in these projects are able to develop their conceptualization of the environment and water sources in a way that results in better water management practices. The implementation of such projects within the education system, could further the integration of knowledge by introducing different representatives of varying stakeholders, such as Municipality, NGO, and residential members. These representatives would allow the students in the formal education system to understand such topics from a different perspective and have a broad set of knowledge-holders and experts to assist in their cognitive development. This is important because the more of an impact that these representatives can make on a learner's impression of the environment, the more likely that the knowledge remains in that learner's long-term memory. In addition, using the asset-based and participatory approaches into the higher levels of education would assist in furthering the cognitive development of learners with relation to water and its conservation.

As suggested by Missingham, involving students in the construction of learning, through asset-based and participatory approaches, have proven to be successful in water education strategies (2013). These can therefore assist to enhance the conceptualization of water and create a sense of responsibility and stewardship toward the environment. Should these approaches be more strongly taught to and promoted among teachers, both employed and in training, water education would be likely to improve. It is therefore suggested that the Department of Basic Education of South Africa consider implementing these strategies when developing the standard under which teachers should be practicing. In addition, regulators from the Government would need to be employed to ensure that these practices are being implemented and that teachers are being successfully trained to apply these approaches. The shift in

education would be working toward sustainable development, as it would be assisting in increasing the awareness of water scarcity, conservation, and preservation. These issues have been impacting South Africa and would therefore find some resolution through the enhancement of the education system.

To further this study, it is critical to continue to monitor how the CAPS packages are affecting the current education system. Although CAPS was published in 2011, the majority of students interviewed had only been enrolled in secondary education under CAPS and could therefore not provide insights as to the concepts and subject matter used throughout primary education since CAPS's publication. The continuation of this study to establish the changes in the education system and the impacts that these new curriculum standards have made would be crucial for this study. In the next decade students of UKZN would have insight into the experience of primary education with the implementation of the CAPS standard; revisiting the study's concept then would allow a full understanding of how the South African education system is promoting environment and water education.

5.4 SDGs and Sustainable Development

In understanding how the current education practiced in eThekwini Municipality is impacting people's awareness of water conservation and water scarcity issues, I have been able to analyse how the cognitive, asset-based, and participatory development approaches can be used toward sustainable development. The cognitive approach is seemingly being used in the formative years through formal and informal education, at school and home, respectively. The asset-based and participatory approaches are also being used by project leaders in the informal education settings to continue to teach all residents about water and the interconnected relationship that their survival holds with their local water sources.

By continuing to implement these strategies and applying them further, eThekwini would be ensuring that they develop the stewardship of its citizens toward their environment in an effort to realize the following Sustainable Development Goals:

- Clean water and Sanitation, goals 6
- Sustainable cities and communities, goal 11
- Responsible consumption and production, goal 12

Through these goals, eThekwini can assist the nation in sustainable development through education and knowledge integration.

5.5 Realization of Objectives

This study set out to achieve the following objectives:

- To assess the level of water education provided to residents from the eThekwini Municipality through primary, secondary, and public education forums.

This is realized by interviewing students and staff members of UKZN Howard College in one-on-one interviews to assess their perceived level of water education water, and how staff believed their interactions with locals through projects and initiatives have represented the level of water education within their communities. Primary education seemed to provide students with a strong understanding of water and the importance of conservation with the use of multiple resources, such as posters, videos, pictures, and through active participation like dancing and singing. Secondary education seemed to present students with similar information of water, but with more depth to this information. However, it seems that the ways in which this water education is taught is less engaging and relatable, which seems to be the reason for the basic level of education received in secondary schools. Public education forums demonstrated a high level of water education, through the use of all three development approaches. Many members of communities, including different stakeholders, participated in these projects which enhanced the integration of knowledge, relatability, and impacts of the experiences.

- To investigate which South African agencies are implementing water education in eThekwini and through which platforms.

This objective is actualized through the assessment of the Curriculum Assessment Policy Statements that are published by the South African Department of Basic Education to all schools across the nation as the standards of education that each grade level should be meeting. In this case, the agency implementing water education within the Municipality is the Government of South Africa's Department of Basic Education. In addition, to ensure that these standards are met through the formal education system, data is collected from students during interviews. Staff members were also interviewed in this regard to investigate how they have participated in the implementation of water education in eThekwini, and to get a firsthand account of the other agencies with whom they have worked. These agencies include representatives from NGOs, the Department of Water and Sanitation, eThekwini Municipality, Umgeni Water, the South African Education and Environment Program, the Environmental Education Association of Southern Africa (EEASA), and the Wildlife and Environment Society of South Africa (WESSA). These agencies participate in public engagement platforms to ensure inclusivity.

- To evaluate the effect of current water education methods and practices on water usage in eThekwini.

The third objective is achieved through the one-on-one interviews with both students and staff members. Through these interviews it is clear that there are other dynamics, beyond education, that impact the residents of eThekwini's water usage. Through student interviews it is obvious that water education does play a significant role in teaching learners how to save water and other basic concepts of water education, but the other dynamics affecting learners and other residents can also impose on their ability to conserve water. Overall, the formal setting of water education is providing residents with a basic understanding of water and the strategies that can be implemented to save water, but the stewardship to conserve water on a daily basis is missing. However, through the informal setting of water education, the practices and methods used, such as knowledge integration and experiential learning, are resulting in residents having stronger connections with their environment and a growing awareness of water use and consumption impacts. Academic participants explained that once local

residents began to actively care for their water sources, they stopped misusing water and managing their resources better.

- To determine the different sources of water education eThekwini distributes to residents and identify other sources that require active participation.

The fourth objective is accomplished through both student and staff interviews. There are various examples given of the materials that were received through formal education, such as posters, videos, music, and brochures. In terms of active participation, a few students explain their experience in attaining further sources of information and find that water education resources were readily available to them both through government and other agency platforms. These included further readings, government information posters, statistical information on the province's water resources, and more. In addition, staff members discussed working with locals who are actively participating to clean their oceans and rivers. Here, the source of education is the act of participating in water clean ups and discussing with other community members of the impacts that water degradation has made on their lives. One academic explained that many sand artists rely heavily on a clean shore and boardwalk, so it is often their own responsibility to clean the areas and ensure that they are well managed. Often, they receive resources such as garbage bags and pamphlets to use and give out to encourage environmental stewardship and water conservation awareness.

5.6 Recommendations

There are few reasons why this study has heavily impacted the way in which I conceptualize common social issues that are encompassing throughout South Africa, particularly in relation to the environment and education. There are also a number of reasons as to why this study was conducted. In this study, I found that all participants had a basic level of water education, but both students and staff participants recognized that few residents, including students, have a strong level of water education. This section consequently provides recommendations that can be used to implement better water education practices, which will work toward enhancing the level of water education amongst all citizens.

I can honestly and conclusively say that the South African government has given schools and teachers guidance as to which topics to present to students and engage them with. However, what I cannot conclusively say is whether these suggestions are taken, and if they are the manner in which they are implemented or 'taught' is not identified or suggested. In reviewing the CAPS documents, it is clear that there are times and resources allocated to teach students about their environment and the importance of water, but it would require nation-wide monitoring to determine whether this is done and the impact that these teachings do and do not have. To ensure that teachers are following these standards, government must carry out studies that go beyond examination of students and teachers. Officials must enhance the ways they monitor classrooms and schools, through spontaneous and even undercover visits, to ensure that the education being given to students through formal settings is reliable and consistent.

Furthermore, the techniques to teach students are suggested by CAPS, but whether teachers practice cognitive, asset-based, and/or participatory approaches in the classroom to introduce water education requires further investigation. This further study would consist of data collection, through interviews and assessments from teachers currently employed, students currently enrolled, and students currently training as teachers within eThekwini. Additionally, participants and leaders of informal education projects need to be interviewed and evaluated to fully understand the different dynamics that transpire within these projects and how participants and leaders interact and learn from one another. Education and training needs to continue to be given to Municipality representatives to ensure that when they are out in the field, they are not creating a dynamic that sees their knowledge as a lecture or imposition, but rather as an opportunity to help local citizens. This is another way in which the power dynamic can be reduced.

It is clear that when speaking with staff interviewees, the project participants that are involved with these interviewees seem to have a stronger bond and sense of responsibility to the environment and their surrounding resources after taking part in more inclusive and participatory initiatives. This study therefore recommends that policy makers in national, provincial, and local government capitalise on

these bonds to further promote initiatives that involve government representatives from all sectors, stakeholders, and local residents to participate in inclusive and participatory initiatives. These could include campaigns to clean local rivers that are negatively impacting residents, hosting open discussions and meetings for all members of community to express their concerns and understand the work that is being done, and initiating information sessions for all members of community, government and others, to participate in learning about the environment, the history of the resources and people, and the ways in which they are currently being impacted by the negative side-effects of mismanagement. These initiatives would be hosted by a certain party, such as Municipality representatives, but in following the asset-based and participatory approach, all participants would be given ample opportunity to speak and express their opinions. Additionally, the hosts of such initiatives would need to present themselves as moderators and equal participants, rather than those in charge and with knowledge.

This study also found that using the asset-based and participatory approaches into the higher levels of education would assist in furthering the cognitive development of learners with relation to water and its conservation. It is hence recommended that asset-based and participatory approaches should be introduced at institutions of higher learning, starting in the Foundation Phase to the FET Phase, in order to deepen the cognitive development of learners as well as reinforce water conservation knowledge for lifelong learning.

To conclusively determine how the current education methods affect a learner's consumption of water, a case study would need to be carried out throughout the City in which students are evaluated before and after water education is presented. Ideally, a study would note a learner's consumption prior to receiving water education, during the time that they would be received water education, and years after receiving this education. However, a study of this stature would require an immense amount of time and resources to be carried out and would need to consider the complexities that affect an individual's water use. As mentioned, the dynamics of race, poverty level, location of residence, and access to water have evidently affected the ways in which people consume water. Additional factors, such as gender and differences between private and public schooling, would likely need to be considered

as they are not mentioned in the collection of this data. Overall, to understand how current education is affecting the sustainable development of eThekwini's water resources, it is important that the evaluation of teaching practices and tactics is carried out. It is therefore imperative that a study of this nature be conducted in the future to ensure that the standards of not just water education, but education are met and maintained.

5.7 Conclusion

This chapter presents the limitations of the research conducted to carry out this study. Additionally, a discussion outlining the key findings of the study, with respect to the objectives is provided, and an analysis that addresses how this study compares to other scholarly findings are provided. The implications of the study's findings, the ways in which the Sustainable Development Framework can be furthered by this study's findings, and the realizations of objectives are also discussed. Lastly, the recommendations that reflect how water education throughout eThekwini, and the nation, can be improved, better monitored, and further practiced are outlined.

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Appendices

Appendix One: Interview Participant Titles

Participant No.	Participant Code Name
1-Staff	Community Activist, specializes in climate change and water adaptation, Researcher.
2-Staff	Environmental Scientist, specializes in environmental geology and geochemistry, Lecturer.
3-Staff	Environmental Scientist, specializes in human geography and plant species, Lecturer.
4-Staff	Geographer, specializes in social and environmental relationships, Senior Lecturer.
5-Staff	Geographer, specializes in urban/rural sociology, Professor.
6-Staff	Mining and Quality Control Engineering, Researcher.
7-Staff	Specializes in land reform, small-scale agriculture, and rural development, Senior Lecturer.
8-Staff	Urban Geographer, specializes in socioecological systems, Researcher.
1-Student	Community Development and Anthropology, graduated secondary education in 2012.
2-Student	Electrical Engineering, graduated secondary education in 2012.
3-Student	Geography and Environmental Management, graduated secondary education in 2011.
4-Student	Geography and Environmental Management, graduated secondary education in 2012.
5-Student	Geography and Environmental Management, graduated secondary education in 2014.
6-Student	Housing, graduated secondary education in 2012.
7-Student	Industrial Psychology, graduated secondary education in 2011.
8-Student	Industrial Psychology, graduated secondary education in 2012.
9-Student	Social Work, graduated secondary education in 2014.
10-Student	Social Work, graduated secondary education in 2012.

Appendix Two: Staff Interview Guide

1. What is your experience with teaching conservation locally? Have you done so with students?

2. What do you find is the attitude of locals toward education, children, young adults, adults, the elderly?

3. How have you found is their relationship with their surrounding environment?

4. What do you think imposes on their ability to become more environmentally conscious?

5. Do you think either the cognitive, asset-based, or participatory development approaches could be beneficial to enhancing water education?

6. How can environmental education, particularly with a focus on water, be improved?

Appendix Three: Student Interview Guide

Development Approaches

- ➔ Do you understand the difference between the three development approaches? Can you explain them in your own terms?
- ➔ What do you think the challenges and strengths of each are?
- ➔ Do you think that you have experienced these in the past, both within an educational setting and not?

Water Education Importance

- ➔ What do you think of when you hear the term 'water education'?
- ➔ Who do you think would benefit them most from water education?
- ➔ What do you think is the impact of successful water education?

Relevance in South Africa

- ➔ What do you know about the water situation in South Africa? Durban?
- ➔ How have you received water education?
- ➔ Who do you think has provided you with the most water education? Please provide examples.
- ➔ Do you think that the current education approaches are effective? Explain.

Connection Between Development Approaches and Water Education

- ➔ Which approach do you believe is more effective for the purposes of enhancing current water education methods?
- ➔ Are there certain characteristics from any of the approaches that you find would be more effective?
- ➔ Who do you think would benefit the most from implementing these characteristics in water education?

Water Conservation Importance

- ➔ Do you believe that you practice effective water conscious methods?
- ➔ What do you think affects the way you conceptualize water conservation?

What are the Limitations?

- ➔ Do you believe that there are any restrictions in using these development approaches to promote water conservation awareness? Please expand.
- ➔ Do you think that there are any limitations in water education?
- ➔ What do you consider as 'successful water education'?
- ➔ What do you think that biggest challenge is in water conservation?

Suggestions/Observations